Mosquitoes of the Genus *Uranotaenia* in the Solomon Islands (Diptera: Culicidae)

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INTRODUCTION

IN A PREVIOUS PAPER (Belkin, 1950) a revision of the culicine mosquitoes of the Solomon Islands was initiated, based on the extensive collections made during the American occupation of these islands from 1942 to 1946. General information on the background, localities, collecting and rearing methods, and location of the material as well as a treatment of the genus *Tripteroides* will be found in that paper.

The present study of the genus *Uranotaenia* is based on the examination of 3,967 specimens of seven species, distributed as to stages in the following manner: 1,459 adults, 415 pupae, and 2,093 larvae. Of this material 107 individuals, including all species, are represented each by a larval (fourth instar) and a pupal skin and the corresponding adult. The importance of such individual rearings cannot be overemphasized in the genus *Uranotaenia* as, in over one half the collections where association of stages was made only through mass or lot rearings, at least two species were involved. The individually reared material forms the basis of this study. The complete chaetotaxy of the larva and pupa of 10 individuals of each species was studied, and in the associated adults all the external morphological features were observed in detail, except as noted under each species. From the study of the individually reared material, distinguishing or diagnostic characters of each species were selected, and these in turn were checked in all the remaining material together with a notation of any striking variation in other characters.

Terminology

In the course of this study it became evident that the terminologies currently in use in descriptive culicidology have failed to keep abreast of, and sometimes have ignored completely, independent findings in comparative anatomy. Accordingly I have attempted to bring up-to-date and to homologize the chaetotaxy of the mosquito larva (Belkin, 1951: 678–698) and pupa (Belkin, 1952: 115–130). These revised homologous terminologies are used in this paper. For the adults, I am using the same terminologies as in the previous paper (Belkin, 1950: 208), although it is evident that these terminologies need to be reviewed also. The few changes I have introduced here are self-explanatory.

Descriptions and Illustrations

In deference to the general practice, I have described the holotypes and allotypes of new species instead of drawing up composite species descriptions from the study of the entire type material as in the past. The immature stages are described from the pupal and larval exuviae of the holotype, thus insuring definite correlation. While such a procedure prevents the inclusion of more than one species in each sex of a new species and is desirable from the standpoint of definitely associating a nominal species with a specimen, I cannot agree that it is advisable taxonomically. Such descriptions of types, to be useful, must be exhaustive and are necessarily lengthy. Therefore, they almost invariably restrict the author to much shorter discussion on variation than

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is needed to characterize the populations described and discourage the publication of much valuable material which could easily be incorporated in the original composite description. Furthermore, this practice tends to the selection of extremes for description and encourages hasty decisions. In mosquitoes it is practically impossible to find a specimen in a condition to show all the important features, particularly in reared material. When males are selected for holotypes, microscopic preparations of genitalia and appendages destroy some diagnostic characters.

To alleviate in part these disadvantages without undue repetition in the text, I have resorted to comparative tables and composite figures. In the case of the latter the same arguments may be used in favor of figures of types as in the case of descriptions. Composite figures based on a study of variation in the new form are of considerably greater importance in the identification of other specimens than a graphic representation of characters already described in detail for the type specimen, whose departure from the norm can be determined by comparison with the composite figure.

I have made the descriptions, tables, and illustrations as complete as time and the material allowed. They may appear unnecessarily detailed and repetitious. Elsewhere it has been pointed out (Belkin, 1951: 678) that, in the immature stages of mosquitoes, culicidologists have largely restricted themselves to a few diagnostic characters, particularly in nonanophelines, and have neglected a multitude of other morphological features which appear to be at least as useful. In a revision such as this, limited both geographically and taxonomically, it is not possible to determine the important characters and leave out the nonessential features since it is essentially a preliminary attempt and no comparable published study is available at the present. It is my intent to continue such studies as it is becoming evident, even in such a limited field, that in addition to those already in use excellent group characters are to be found in the thoracic and abdominal chaetotaxy of the larvae and the cephalothoracic chaetotaxy of the pupae. As every species treated here belongs to a distinct species group and adequate material of related forms from adjacent areas was not available for study, little can be said, as far as specific diagnostic characters are concerned, except that it appears that the larval and pupal chaetotaxy may be of considerable value if it is studied quantitatively as well as qualitatively. For the present I have had to use a very few disjunctive characters to distinguish the new species described here because of the paucity of material and inadequate descriptions. Whether the forms described here are species or subspecies cannot be decided without further comparative studies. I prefer to consider them for the present as distinct species. In any event, I hope that it will be possible for other workers to recognize the forms described here and also to test the usefulness of some of the characters in the diagnosis of related species.

In the descriptions, strictly generic characters are not repeated since they are indicated under the discussion of the genus at the beginning of the paper. In the larva the mouthparts were not studied at all, and in the female the genitalia were also neglected. Otherwise all characteristics previously described were investigated.

In the tables on the setal branching, the mean and other statistics were not determined as the samples were not adequate to provide significant figures except in cases where the desired information was evident without computations. It appears that mathematical treatment of multiple characters of chaetotaxy may prove a valuable tool in diagnosis of related species. For the present I have confined the data to an indication of the extremes of variation and of the "usual number" of branches in the order of frequency. The latter is the mode alone or the mode followed by the next class (or classes) if it is one half or more of the mode. In general the "usual number(s)"

represents 75 per cent or more of the total frequencies observed. In dendritic hairs with 15 or more branches the figures are only approximate, as the branching varies greatly and is difficult to observe accurately.

The illustrations are semidiagrammatic in nature, prepared with the aid of an ocular reticule, and are composites to show the "usual" condition, an approximation of the mode, on the basis of the observations and measurements of the individually reared material. The figures of the female thorax leave out all detail of the mesonotum, except scale pattern, and are very inaccurate in the outline of the head as they were drawn from pinned specimens. In the male genitalia the anal segment has been left out completely as it shows no useful characters, being apparently completely unsclerotized. In the details of the legs only pertinent features are indicated. The outlines of the unsclerotized portions of the larval thorax and abdomen are only approximate, whereas those of the larval head and terminal abdominal segments and pupal structures are somewhat more accurate. All elements of chaetotaxy are shown in as accurate proportions as could be determined.

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Abbreviations

ADULTS. The standard abbreviations used by Edwards (1941: 7–9) for the thorax and those used by Matheson (1944: 12–17) for the male genitalia are followed. The leg segments are designated by a combination of a Roman numeral with an abbreviation of the segment as follows: I C (prothoracic coxa), II TR (mesothoracic trochanter), III F (metathoracic femur), I Tib (prothoracic tibia), II Tar (mesothoracic tarsus), III CL (metathoracic pretarsal claw). In the case of the tarsus an Arabic numeral is appended to indicate the subsegment as in: III Tar 1 (proximal segment of metathoracic tarsus), II Tar 5 (distal segment of mesothoracic tarsus). The measurements of the leg segments are given in comparative figures, using the fore tibia as the basic unit.

IMMATURES. The following abbreviations for body regions and special features are used:

A—antenna
C—head (larva), cephalothorax (pupa)
CS—comb scale
G—genital lobe
M—mesothorax
MT—marginal teeth of anal saddle
P—prothorax
PD—paddle
PT—pecten tooth
S—siphon
T—metathorax
I–VIII—segments of abdomen
IX—"anal flap" of pupa
X—segments X–XII

The individual elements of the chaetotaxy are indicated by prefixing the number of the hair to the abbreviation for the segment or structure as in: 1-C (head hair No. 1), 6-II (hair 6 on abdominal segment II), 5-IV–VI (hair 5 on abdominal segments IV, V, and VI), 3–5-II (hairs 3, 4, and 5 on abdominal segment II), 2, 4-IV, VI (hairs 2 and 4 on abdominal segments IV and VI).

The type of branching is abbreviated thus: b (branched) when the branches arise at or near base; f (forked) when the branching takes place at or beyond the middle of the hair; d (dendritic) when the branching is secondarily dichotomous or irregularly dendritic.

GENERAL CONSIDERATIONS

Genus URANOTAENIA

1891. *Uranotaenia* Lynch Arribalzaga, La Plata. Univ. Museo La Plata, Rev. 1: 375, 2: 163–164. *Type species: Uranotaenia*

pulcherrima Lynch Arribalzaga, 1891; Las Conchas, Buenos Ayres (the second of two species, by selection of Neveu-Lemaire, Soc. Zool. France, Mem. 15: 227. 1902).

1905. *Anisocheleomyia* Theobald, Entomologist 38: 52–53. *Type species: Anisocheleomyia nivipes* Theobald, 1905; Queensland (the first of two species, by selection of Brunetti, Indian Mus. Calcutta, Rec. 10: 55. 1914).

1905. *Pseudouranotaenia* Theobald, Jour. Econ. Biol. 1: 33. *Type species: Pseudouranotaenia rowlandi* Theobald, 1905; New Amsterdam, British Guiana (= *Uranotaenia nataliae* Lynch Arribalzaga, 1891). Monobasic.

1912. *Pseudoficalbia* Theobald, Linn. Soc. London, Trans., (2) Zool., 15: 89–90. *Type species: Pseudoficalbia pandani* Theobald, 1912; Mahé, Seychelles (the first of two new species, two other species mentioned, *fide* Howard, Dyar, and Knab, Mosq. North, Central Amer. and West Indies 4: 899. 1917).

About 130 valid species of *Uranotaenia* are recognized at the present time, largely from the Old World tropics but with representatives in all zoogeographical regions. The group is so distinctly characterized in the adult stage that only three additional generic names have been proposed for this considerable assemblage of species. The individual species offer such striking differences in ornamentation and special modifications that only about 35 additional trivial names have been proposed which are now considered to be synonyms, some of which may have to be resurrected in the future. This unusual situation is partially due to the neglect of this genus by culicidologists as the few workers who have studied the group in the tropics have found it to be represented by a large number of species even in limited areas. It appears from the present work that some of the extremely widespread species are actually complexes of closely related forms. No monograph of any kind has been published on this genus as yet.

The taxonomic distinctiveness of *Uranotaenia* in the adult stage has led some workers, notably Dyar (1928: 415), to recognize a separate tribe for this genus, but more recent workers have not followed this action. No subgenera have been recognized since Edwards (1932: 97) synonymized the four generic names proposed for this group, although he and subsequent authors have used *Pseudoficalbia* as a group name for the nonornamented species of *Uranotaenia*. The only attempt to divide the genus into natural groups was made by Edwards (1941: 43–44) for Ethiopian species and was based on adult characters only. Although these groups have many characters in common, they are apparently distinct to a much greater degree in the larval and pupal stages. The presence of extremely different types of larvae and pupae in this genus has not been appreciated by culicidologists in general, and this has led to such statements as "Why did *Uranotaenia* stand still in an evolutionary sense while *Aedes* gave rise to the largest and most successful group of subarctic mosquitoes" (Ross, 1951: 132). There appear to be several different evolutionary lines in *Uranotaenia*, some of which have invaded the same ecological niches, such as water in living plants, in dead plant material, in tree holes, etc. The immature stages as well as the detailed morphology of many such forms are unknown at the present. Little can be done in the classification of this group until these gaps are filled, as such ecological situations are notorious for the development of parallel structures in unrelated forms.

In the Solomons there are three distinct groups of species, two of which are closely related and very distinct from the third. In our present state of world knowledge of *Uranotaenia* it is impossible to determine whether or not these groups are of subgeneric rank, and rather than add other names to synonymy I prefer only to bring out the differences and similarities at this time.

Adult Characters

In the Solomons, adults of *Uranotaenia* can be recognized superficially from all other mosquitoes by the following combination of characters: small size; straight proboscis (usually swollen apically); pulvilli absent; squama bare; cell R_2 always distinctly shorter than vein R_{2+3}; vein 1A strongly curved apically and ending at level of or before the separation of Cu_1 and Cu_2; wing membrane with minute microtrichia, not visible under a magnification of 50×; palpus extremely short in both sexes (stated to be 2-segmented but not segmented in Solomon Island forms).

Edwards (1941: 41–43) gave an excellent characterization of the genus in the adult stage. The following features noted in the Solomon Island species should be added.

Head: Frontal tuft well developed in some species; orbital bristles (not counting frontal pair) often conspicuously interrupted, arranged 1:3; *palpus* not segmented, composed of a single piece in both sexes, between 0.10 and 0.05 of proboscis.

Thorax: One to several propleurals; one posterior pronotal; one spiracular or none; one pre-alar; upper mesepimeral may be absent; dorsocentral bristles strong, acrostichals weak to moderate, supra-alars strong.

Legs: Male claws of mid leg with weaker claw sometimes almost as long as stronger claw, sometimes apparently absent, stronger claw with a tooth in *U. atra;* in both sexes apex of fore and mid tibia with specialized bristles and scales forming tufts or combs.

Wing: No bristles on base of R or Sc.

Male genitalia: Segment VIII long, forming a broad band at base of genitalia proper, tergite without hairs in all Solomon Islands species; mesosome with ventral bridge in some species.

Edwards (1941: 43–44) recognized four groups in the Ethiopian region on the basis of thoracic and wing scaling and characters of the male genitalia. He did not attempt to correlate these differences with larval or pupal specializations. His groups B and D are not represented in the Solomon Islands. I have changed his nomenclature from group to section to distinguish them from species groups. Apparently all but one species (*U. quadrimaculata*) from the Solomons belong to section A of Edwards on the basis of adult structures. The section was characterized as follows: "Scutal scales mostly narrow but a supra-alar stripe of broad scales; *apn* scaly; wings usually with some white scales in lines. Terminalia (where known) with tergite bare, its lateral corners produced into pointed processes or rounded knobs; style short and rather stout; *lp* with strong spines." Since it appears that the New World species (Lane 1943: 137–161), including the type species of the genus, belong to this section although forming a distinct subsection, it may be considered as representing the typical *Uranotaenia*. In the Old World, section A is a complex one consisting of several subsections. In the Solomons *U. wysockii* is a member of such a subsection differentiated from the other species chiefly by adaptive characters in the larva and pupa and appearing very similar in the adult stage. I propose to recognize in the Solomons subsection A1 for the generalized species breeding in ground water and subsection A2 for *U. wysockii* breeding in plants.

U. quadrimaculata superficially fits into section C of Edwards which was characterized as follows: "Scutal scales all narrow, *apn* devoid of scales. Terminalia with tergite bare, more or less produced in middle, but not at corners; style long and slender; *lp* with small spines." Scales are present on *apn* in *U. quadrimaculata*, and as far as I can determine from descriptions it has a much shorter cell R_2 than any Ethiopian member of this section. In addition the pre-alar area is not distinctly separated from the sternopleuron, an unusual feature in the genus. In the immature stages *U. quadrimaculata* and related Papuan forms appear very distinct from the Ethiopian species. The type species of *Pseudoficalbia* belongs to section C, but because of these differences

I do not feel justified in using it for Australasian species. Instead, for the present I prefer to use subsection C2 for the Papuan forms related to *U. nigerrima* and *U. quadrimaculata*.

It is probable that other distinctive groups of *Uranotaenia* await characterization among the Oriental and Australasian species, particularly the nonornamented forms, some of which are undoubtedly closely related to ornamented forms whereas others are very different. Until these are studied, nothing but speculations can be made about the relationship of the Solomons species.

The different sections present in the Solomons are characterized as follows:

Section A1.—Ninth tergite bare, emarginate apically, and with lateral lobe either broad or produced into spine; mesosome with strong teeth or spines arranged into apical and median groups. A pre-alar sclerite distinctly separated from upper sternopleuron. Cell R_2 short or very short, between 0.45 and 0.3 of vein R_{2+3}. Head with at most a few erect scales on vertex; at least a narrow orbital line of light scales; frontal tuft present or absent. Palpus between 0.05 and 0.08 of proboscis. Scutal vestiture largely composed of dark, narrow, curved scales with a patch or line of broad light scales restricted to front of wing root or extended cephalad. Pleura with *apn* light-scaled; *ppn* bare or with light scales; *stp* with transverse patch of light scales in upper third and variable number of light or dark scales in lower two thirds; only one strongly propleural; one spiracular present; two or more upper mesepimerals present. Legs without light-scaled markings on femora. Included species: *U. atra* Theobald, *U. barnesi* n. sp., *U. civinskii* n. sp., *U. solomonis* n. sp., *U. sexaueri* n. sp.

Section A2.—As in section A1 except for the following: three or more strong propleurals; spiracular and upper mesepimerals absent; conspicuous white knee spots on all femora. Included species: *U. wysockii* n. sp.

Section C2.—Ninth tergite bare, broadly produced in middle and without lateral lobe; mesosome with numerous weak serrations not arranged into apical and median groups. Pre-alar area not distinctly separated from upper sternopleuron. Cell R_2 very short, less than 0.3 of vein R_{2+3}. Head with numerous conspicuous erect scales on vertex, no distinct orbital light-scaled line; frontal tuft not developed. Palpus about 0.1 of proboscis. Scutal vestiture of dark, narrow, curved scales, lighter near wing root (in related species broad scales over anterior end of *ppn*). Pleura with *apn* with translucent scales, no scales on other sclerites; four strong propleural bristles; one spiracular; three or four upper mesepimerals. Legs entirely dark-scaled. Included species: *U. quadrimaculata* Edwards and related Papuan species.

Edwards has shown the importance of the shape of the ninth tergite of the male genitalia in determining relationships in this genus. Unfortunately, few other workers have paid much attention to this basic character, perhaps because of the minuteness of the genitalia. The shape of the clasper has been recognized as offering specific differences as well as group differences. It appears too that the ornamentation of the mesosome as well as its shape may be of considerable diagnostic value. In the Solomons species the shape of the paramere is distinctive in several species. Of the other characters used previously, not enough attention has been given to the proportions of leg segments which are distinctive in every species I have studied. It appears that the thoracic scutal and pleural ornamentation is not as important a character as believed by Edwards as several nonornamented species in the Oriental region undoubtedly are closely related to ornamented forms.

Pupal Characters

According to Edwards (1941: 364–365) and Penn (1949: 28–29), the pupal stage of *Uranotaenia* is not well defined. Although it is

true that it is not as clearly distinguished as the adult stage, the majority of species are readily recognized. Perhaps the distinctiveness of the adults of *Uranotaenia* has been overemphasized, as the extremely small size of the microtrichia is actually the only character possessed by all species that distinguishes them from other mosquitoes, and this is a relative character whose constancy has not been checked.

The presence of several distinct types of pupae hinders the diagnosis of the genus and indicates its complexity, but the following characters apply to the majority of species: abdominal hair 1-IX better developed than in any other genus, at least one half as long as segment, usually thickened; palpal case very short; torus case exceptionally large; hair 4-C placed far caudad and mesad of 5-C; hair 6-C single, usually thickened and very long, always longer than 7-C; hairs 6, 7-C far removed from 4, 5-C; mesoscutum very strongly arched; paddle with part mesad of midrib broader than outer part; cercal plates of female indistinct, usually poorly sclerotized and never projecting.

The different sections present in the Solomons are differentiated as follows:

Section A1.—Trumpet with a distinct slit into meatus from pinna, placed closer to middorsal line than to wing case; paddle with one weak hair and with indistinct serrations, distinctly longer than wide; cephalothoracic and abdominal hairs conspicuously branched; hairs 8, 12-II absent.

Section A2.—Trumpet without slit, placed closer to wing case than to middorsal line; paddle without hair; other characters as in section A1.

Section C2.—Trumpet without slit, placed closer to wing case than to middorsal line; paddle with 2 strong terminal hairs and strong external and internal serrations; cephalothoracic and abdominal hairs not conspicuously branched; hairs 8, 12-II present.

Larval Characters

The larval stage of *Uranotaenia* is by no means as distinct as generally regarded. Hopkins (1936: 40–41), Barraud (1934: 59), and Edwards (1932: 97) have given good general diagnoses, but exceptions to the most striking characters—comb plate and single head hairs 5 and 6—are becoming more numerous as more larvae are described.

In the Solomons all the known *Uranotaenia* can be distinguished in the larval stage as follows: *Head:* Usually slightly longer than broad but sometimes slightly broader than long; hairs 8 and 6 spike-like or simple or even branched; maxillary suture (premaxillary, mental, gular) always completely absent. *Antenna:* Short, smooth or minutely spiculate; hair 1 short or long, single or branched. *Thorax:* Lateral and ventral hairs plumose or single. *Abdomen:* Dorsal and ventral hairs slender stellate tufts or single; lateral hair strongly developed on I, II or I–VI; comb plate always developed, sometimes united with its mate dorsally; comb scales and pecten teeth usually fringed but may be simple or with a few basal denticles; anal saddle completely ringing segment; acus always present.

The sections present in the Solomons may be differentiated as follows:

Section A1.—Thorax and abdomen with dorsal and ventral stellate tufts; antennal hair 1-A at middle or near base; thoracic hairs 8, 9-M, 7, 9-T long multiple barbed tufts; abdominal hairs 6 strongly developed on I and II, weak and stellate on other segments; hair 8-I developed, hair 11-I absent; comb plates separate; comb scales and pecten teeth fringed laterally or apically; ventral valve hair 13-S twisted at base; all valve hairs single. Antennal hair single, short; head hairs 5, 6-C spike-like; abdominal hair 4-II stellate; pecten not reaching beyond 0.5 of siphon; siphonal hair 1-S less than 0.5 of siphon length; head hair 14 thickened, spike-like.

Section A2.—Like section A1 except: antennal hair 1-A branched, about as long as antenna; head hairs 5, 6-C slender, not spike-like; abdominal hair 4-II forked, not stellate; pecten reaching to 0.8 of siphon; siphonal hair 1-S about as long as siphon; head hair 14 dendritic.

Section C2.—Thorax and abdomen without dorsal or ventral stellate tufts; antennal hair 1-A near apex of antenna, single; thoracic hairs 8-M, 7-T short, multiple but not barbed; hairs 9-M, T long, single; abdominal hairs 6-I–IV subequal, all arising from tubercles; hair 8-I absent, hair 11-I present; comb plates united dorsally into a saddle; comb scales and pecten teeth simple, without fringes but with or without basal denticles; ventral valve hair 13-S a simple single hair not twisted at base; some valve hairs branched; anal hairs 2, 3, 4-X single; head hair 14 a simple, slender hair.

Species groups within these sections are separated in the Solomons chiefly on the following characters: head hairs 4, 9, 11-C; antennal hairs 1, 2, 3, 4-A; thoracic hairs 3, 4, 7, 9, 10, 14-P; abdominal hairs 1, 6, 13 on segments I–VII; pentad hairs; development of ventral valve and its hairs; hairs 2, 3, 4a, b-X; size of anal segment. Individual species are distinguishable apparently on the differential development and branching of all the larger hairs, on characters of comb scales and pecten teeth, length of siphon, spiculation of caudal margin of siphon, and length of anal gills.

Montschadsky (1930: 580–582; pl. 8, fig. 12) describes and figures for *U. unguiculata* Edwards, 1913, a process arising from the spiracular rim that is similar in form to the twisted hair 13-S in larvae of sections A1 and A2 in the Solomons. Both of these characters are restricted to *Uranotaenia* and may prove to be of value in subdividing the genus.

Biology

The majority of species of *Uranotaenia* whose immature stages are known utilize ground waters for breeding, being found in swamps, marshes, and streams as well as in temporary pools. The individual species or groups vary greatly in their requirements for light, oxygen, and protective cover. As far as known, all species utilizing such habitats for breeding lay their eggs in rafts which are superficially similar to those of *Culex* and *Mansonia*. The larvae of these species rest parallel to the surface film and immediately below it because of the shortness of the siphon and the angle it forms with the abdomen. They spend most of their time near the surface, apparently feeding just below the surface film. Certain species are easily mistaken for the younger stages of anophelines, particularly as they are often present in association with them. The jerky movements of these larvae are also suggestive of anophelines. All the species in the Solomons except *U. wysockii* and *U. quadrimaculata* belong to this group. I have collected egg rafts of these forms but have not reared them.

A number of species have been reported from specialized ground waters such as rock holes. It appears that some of these forms are morphologically distinct from the above-mentioned group and may lay eggs singly in some cases. *U. stonei* Bohart and Ingram, 1946, from Okinawa has a very peculiar larva with unusual behavior and resting position but apparently in the adult stage shows resemblance to section A1 in the shape of the ninth tergite of the male. On the other hand, less specialized forms, such as the *atra*-group which utilize crab holes for breeding, retain their similarity to ordinary ground-pool breeders.

Several species are restricted to breeding in water collections in living plants such as species of *Pandanus*, *Nepenthes*, *Colocasia*, *Alocasia*, *Curcuma*, etc. It is apparent that members of more than one section of the genus utilize this type of habitat. In the Solomons *U. wysockii* belongs to this ecological group. I have never found mosquito egg rafts in water collections in living plants and consider it likely

that eggs of mosquitoes in such habitats are laid singly in all genera including *Uranotaenia* and *Culex*. The larval behavior of *U. wysockii* is discussed under that species. It should be noted that both the behavior and superficial morphology of plant-inhabiting species show marked convergence in entirely unrelated groups.

A fourth group of larval habitats utilized by *Uranotaenia* is found in water collections in various types of dead plant materials found on the ground. Tree holes either belong to this class or may be considered as intermediate between it and the preceding class. Several species have been reported breeding in water collections in opened coconuts, coconut husks, fallen coconut spathes, fallen bamboo, and various types of artificial containers. In the Solomons *U. quadrimaculata* breeds in such habitats but in addition is found in taro (*Alocasia*, *Colocasia* sp.). Again it appears that representatives from several distinct groups of the genus have invaded this ecological niche. It is probable that eggs are laid singly in these species, as reported by Bohart and Ingram (1946: 58) for *U. bimaculata* Leicester, 1908. I have never found egg rafts of *U. quadrimaculata* in over 50 collections. The appearance and behavior of these larvae is very different from the ordinary ground-water inhabitants and is discussed in more detail under the section on the biology of *U. quadrimaculata*.

In the Solomons all the species of *Uranotaenia* develop rather slowly in the laboratory, and I am under the impression that it takes at least 10 days for the completion of the aquatic cycle. The pupal stage in the laboratory lasts 2 to 3 days and even longer in the case of *U. wysockii*.

Adults of *Uranotaenia* are delicate, shy mosquitoes which apparently do not normally feed on human blood. *U. geometrica* Theobald, 1901, was reported on the authority of Lutz (Theobald, 1901: 248) as being a severe biter, but this has not been confirmed (Shannon, 1931: 24; Lane, 1943: 138). The only definite records on blood feeding are those of Davis and Philip (1931: 137, 138) on bird blood and Remington (1945: 32–37, 64–68) on amphibian blood. In the Solomons all the observed species are fairly active during the day but are restricted to shaded situations. They occasionally land on human beings but in my experience never bite. The majority of species are found on moist surfaces near the breeding places, and an occasional specimen shows blood. Several species come readily to electric lights, indicating that their activity is not restricted to daylight hours.

Affinities of Solomons Fauna

The Solomons species of *Uranotaenia* as here understood all belong to species groups represented in the Australasian and Oriental regions. All the species are endemic except *U. atra*. The specimens determined as the latter are probably also a distinct species in the Solomons, but because of the insufficient knowledge of this group in the other areas of its occurrence they are not separated nomenclatorially for the present. All the species show very strong affinities with Papuan and Philippine representatives of the same groups except *U. wysockii*, a member of the Oriental *alboannulata*-group which has not been recognized previously from these subregions.

There is only one representative of each species group in the Solomons, and in each case the separation from related forms is quite distinct in all known stages although based on relatively few characters. Probably additional characters will become apparent when related species are studied in greater detail. *U. wysockii* is an exception for the reason stated above, and whether it is a form peculiar to the Solomons and without close relatives in adjacent areas is not known. Detailed discussions of the relationships will be found under the section on taxonomic discussion for each species.

Whether the Solomons forms described here are full species or should be treated as subspecies only is a matter of opinion. The differences noted are constant, occur in all

stages, and are more striking than those between *U. quadrimaculata* and *U. nigerrima*, which Edwards considered distinct species.

To the east of the Solomons only three species of *Uranotaenia* have been reported from the Pacific islands. All of them appear to be very distinct from any species found in the Solomons. Perry (1946: 11, 14) reports *U. tibialis* Taylor from Espiritu Santo, New Hebrides. I have seen a single damaged female thought to be this species from Efate, New Hebrides (Rentaban Bridge, Sept. 20, 1942, K. L. Knight Coll. USNM). It appears to be a distinct species, possibly not related to *U. tibialis* at all. The abdomen is broken off, but the following features are discernible: broad scales of head all dark, no indication of light orbital line, one pair of long, erect, vertical scales in addition to shorter, lighter, erect occipital scales; scutum with short, broad patch of bluish scales on front of wing root; *apn* and *stp* each with broad patch of broad, bluish scales but integument not distinctly light in line with the patches; wing with white scales as in *tibialis*-group, distance between crossveins about 1.4 of m-cu; hind tarsus white from extreme apex of segment 2. Perry (1946: 11) states that in the larva the comb scales are not fringed or spined and that head hairs 5 and 6 are spike-like. It seems unlikely that the characteristic leaf-like antennal hairs could have been overlooked. At any rate, this undescribed species appears to have very little relationship to the Solomons *Uranotaenia*. The other two species from the South Pacific are both reported from Fiji. *U. painei* Edwards, 1935, is entirely different from any Solomons species, particularly in the larval stage, and appears to have no close relative anywhere in the Papuan subregion. *U. colocasiae* Edwards, 1928, appears superficially to be related to the *nigerrima*-group but is very unlike *U. quadrimaculata* of the Solomons. Thus, as is shown also in *Tripteroides* (Belkin, 1950: 214), there appear to be no strong affinities between the mosquito fauna of the Solomons and those of the South Pacific islands to the east.

Keys to Species

1. ADULTS (MALES AND FEMALES)

1. Posterior pronotum and supra-alar area in front of wing root each with a dark velvety integumentary spot; vertex of head with numerous conspicuous erect scales. . . . . *U. quadrimaculata* Edwards

   Posterior pronotum and supra-alar area without dark spots; vertex of head with at most a few inconspicuous erect scales. . 2

2. Thorax with broad whitish integumentary area embracing lower margin of scutum in front of wing root and upper half of pleura; vertex of head with broad scales all whitish . . . . . *U. sexaueri* n. sp.

   Thorax with scutal integument all dark but with a narrow patch or a longitudinal line of whitish or bluish scales on lower margin, pleura with a median longitudinal line or patch of light scales; vertex of head with some of the broad scales dark. 3

3. Scutum with a lateral longitudinal line of white scales extending around the front margin from wing root to wing root; three or more strong propleural bristles; spiracular and upper mesepimerals absent; conspicuous white knee spots on all femora. . . . . *U. wysockii* n. sp.

   Scutum with a lateral longitudinal line or patch of white or bluish scales restricted to area between transverse suture and wing root on each side; at most one strong propleural bristle; spiracular and upper mesepimerals present; femora without knee spots, at most indistinctly lighter apically at articulation. 4

4. Abdomen with conspicuous dorsal white scaling on at least one segment; light scaling of head and thorax white or slightly bluish, arranged in narrow lines on thorax; distinct frontal tuft present; males with front tibia and tarsus without specialized bristles or scales. 5

Abdomen without conspicuous dorsal white scaling, lateral light patches may be present but not visible from above; light scaling of head and thorax strongly azure blue, arranged in broader patches on thorax; no frontal tuft; males with front tarsus or tibia and tarsus with specialized tufts of bristles and scales.....6

5. Hind tarsus white-scaled from middle of segment 3; light scaling of head, thorax, and wing almost pure white; very narrow orbital light line; supra-alar line extending cephalad of spiracle; abdominal tergite 5 with white apical transverse band extending to sternite.....*U. solomonis* n. sp.

Hind tarsus white-scaled from apical fifth of segment 2; light scaling of head, thorax, and wing distinctly bluish; broad orbital light line; supra-alar line not reaching spiracle and angled cephalodorsad; abdominal tergite 5 completely dark-scaled.....*U. civinskii* n. sp.

6. Tarsi all dark-scaled; wing scales all dark dorsally; abdominal tergites with inconspicuous lateral white patches; male with first segment of front tarsus excavated and shortened, second segment without tuft of long bristles and scales, fore tibia without long apical tuft of scales.....*U. atra* Theobald

Hind tarsus white-scaled from apex of segment 2; wing scales iridescent bluish on base of R, Cu, and 1A; abdominal tergites completely dark-scaled; male with first segment of front tarsus not excavated but with long basal bristles, second segment with large tuft of long bristles and scales, fore tibia with long apical tuft of scales.....*U. barnesi* n. sp.

2. MALE GENITALIA

1. Clasper slender, gradually narrowed apically; ninth tergite not emarginate apically and without lateral lobes; mesosome with numerous short teeth not arranged into apical and median groups.....*U. quadrimaculata* Edwards

Clasper broad, parallel-sided or expanded before apex; ninth tergite emarginate apically, with more or less distinct lateral lobes; mesosome with a few long spines or teeth arranged in apical and median groups.....2

2. Mesosome with a complete dorsal sclerotized bridge, each plate with two apical spines and three or more teeth on median process.....*U. solomonis* n. sp.

Mesosome with only a narrow basal dorsal sclerotized bridge, each plate with only one apical and one median strong spine.....3

3. Lobe of ninth tergite produced as a strongly sclerotized blunt spine that is longer than broad.....*U. civinskii* n. sp.

Lobe of ninth tergite broadly rounded, not produced as a distinct spine, always broader than long.....4

4. Apical spine of mesosome plate short, arising at extreme apex, median spine arising close to it.....5

Apical spine of mesosome plate long, arising distinctly before apex, median spine arising more ventrally.....6

5. Ninth tergite broadly emarginate apically median bridge distinctly shorter than width of emargination, lateral lobe distinctly produced.....*U. wysockii* n. sp.

Ninth tergite narrowly emarginate apically, median bridge at least as long as width of emargination, lateral lobe broadly rounded.....*U. sexaueri* n. sp.

6. Ninth tergite very narrowly but deeply emarginate apically, median bridge short, lateral lobe very broadly rounded; basal lobe of sidepiece with numerous bristles.....*U. atra* Theobald

Ninth tergite broadly and very shallowly emarginate apically, median bridge long, lateral lobe slightly but acutely produced; basal lobe of sidepiece with few bristles ..... *U. barnesi* n. sp.

3. PUPAE

1. None of the larger abdominal hairs conspicuously branched; trumpet index 3.0 or less; paddle with two distinct hairs and strong inner and outer serrations; hairs 1–3-C single; hairs 8, 12-II present..... ..... *U. quadrimaculata* Edwards

   Larger abdominal hairs conspicuously branched; trumpet index 3.5 or more; paddle with one indistinct hair or none, inner serrations always very weak, outer poorly sclerotized; hairs 1–3-C multiple; hairs 8, 12-II absent.....2

2. Trumpet index at least 10; hair 8-C with long central stem and short basal branches; hair 2-III laterad or cephalad of 1-III...3

   Trumpet index at most 6.5; hair 8-C without strong central stem, branches subequal; hair 2-III distinctly mesad of 1-III.....4

3. Hair 4-IV, V single, longer than two following tergites together; trumpet uniformly dark, tracheoid to pinna..... ..... *U. atra* Theobald

   Hair 4-IV, V 2–5b, shorter than two following tergites together; trumpet dark on tracheoid and apex, light in between, tracheoid to 0.55 from base... *U. barnesi* n. sp.

4. Trumpet without slit in meatus; paddle almost as wide as long, without hair; hair 4-IV–VI usually 3b, branches heavy, curved apically, extending to middle of second tergite following..... *U. wysockii* n. sp.

   Trumpet with a distinct slit in meatus; paddles distinctly longer than wide, hair present but small; hair 4-IV–VI usually with more slender straight branches....5

5. Hair 1-II secondarily branched; hair 4-V–VII usually 3b, distinctly longer than following tergite and distinctly longer than hair 1 on corresponding segments; trumpet index 5.0..... *U. civinskii* n. sp.

   Hair 1-II primarily branched only; hair 4-V–VII usually 4–6b, slightly longer than following tergite and about as long as hair 1; trumpet index 4.0 or less.....6

6. Trumpet dark basally, golden brown on apical half or more; hair 1-II 6, 7b; paddle serrations very indistinct, restricted to apex ..... *U. sexaueri* n. sp.

   Trumpet dark throughout; hair 1-II 10, 11b; paddle serrations distinct on apical half of external margin... *U. solomonis* n. sp.

4. LARVAE (FOURTH INSTAR)

1. Thorax and abdomen without dorsal or ventral stellate hairs; hair 1-A at apex; hairs 8-M, 7-T short, multiple but not barbed; hairs 9-M, T single; hair 6-I–IV of approximately equal size, all arising from basal tubercles; comb plates united dorsally into saddle; comb scales and pecten teeth not fringed laterally or apically, but may have a few basal denticles..... ..... *U. quadrimaculata* Edwards

   Thorax and abdomen with slender dorsal and ventral stellate hairs; hair 1-A near middle or base; hairs 8-M, 7-T long, multiple, barbed; hairs 9-M, T multiple, barbed; hair 6-I, II about three times or more longer than 6-III, IV, the latter without basal tubercles; comb plates separate, not united dorsally into saddle; comb scales and pecten teeth with lateral or apical fringes.....2

2. None of head hairs developed into spikes; hair 1-A long, branched, reaching beyond apex of antenna; hair 1-S as long as siphon; pecten extending to 0.8 of siphon..... ..... *U. wysockii* n. sp.

Hairs 5, 6-C developed into heavy spikes; hair 1-A short or minute, never reaching apex of antenna; hair 1-S distinctly shorter than siphon; pecten not extending beyond 0.5 of siphon.....3

3. Hairs 2–4-A leaf-like; hair 4-C long, simple; hair 9-C short, half or less of 8-C; hair 2-X 4, 5b; siphon index 3.5, valves very long; hairs 1-P, 5-M frayed apically..... .....*U. barnesi* n. sp.

Hairs 2–4-A simple, acute; hair 4-C short, branched; hair 9-C about as long as 8-C; hair 2-X with no more than three branches; siphon index 4 or more, valves moderate; hairs 1-P, 5-M simple and acute apically..4

4. Hair 14-P single; either anal gills short, rounded, hardly longer than wide *or* hair 6-I, II 3b.....5

Hair 14-P multiple; anal gills long, bluntly tapered, at least four times as long as wide; hair 6-I, II 2b.....6

5. Hair 6-I, II 2b; hair 11-C 2, 3b; hair 3-P 3–5b; hair 7, 9-P single; hair 3-VIII 4, 5b; hair 2-X 2b; anal gills short, rounded, hardly longer than wide; head poorly pigmented, spikes poorly developed..... .....*U. atra* Theobald

Hair 6-I, II 3b; hair 11-C 4–6b; hair 3-P 6–10b; hair 7, 9-P 2, 3b; hair 3-VIII 3b; anal gills about four times as long as wide, bluntly tapered apically; head heavily pigmented, spikes heavy....*U. solomonis* n. sp.

6. Hair 14-P 12–16b; hair 1-A less than diameter of antenna in length; hair 9-C 4b; hair 11-C 8, 9b; hair 4-P 2b; hair 9-P 4, 5b; hair 3-VIII 7, 8b; middle scale of comb enlarged.....*U. sexaueri* n. sp.

Hair 14-P 5–8b; hair 1-A about twice diameter of antenna in length; hair 9-C 2, 3b; hair 11-C 3–6b; hair 4-P 3b; hair 9-P 2, 3b; hair 3-VIII 4–6b; middle scale of comb not enlarged.....*U. civinskii* n. sp.

CONSIDERATION OF SPECIES

1. Uranotaenia atra Theobald, 1905
Plates 1, 2

1905. *Uranotaenia atra* Theobald, Budapest. Magyar Nemzeti Muz., Ann. Hist. Nat. 3: 114. *Type:* F; Muina [Muima, near Madang], New Guinea, 1900 (Biro) [Budapest. Magyar Nemzeti Muzeum].

1905. *Uranotaenia coeruleocephala lateralis* Ludlow, Canad. Ent. 37: 385–386. *Types:* 4F; Cottabatto, Mindanao, P. I., 25 Jun. 1905 (E. B. Vedder) [USNM].—1922. Edwards, Indian Jour. Med. Res. 10: 460 (syn.).

1908. *Uranotaenia cancer* Leicester, Kuala Lumpur. Inst. Med. Res., Studies 3(3): 215–217. *Types:* M and F; Port Swettenham and Klang, Malay Penin. (Leicester) [BMNH].—1922. Edwards, Indian Jour. Med. Res. 10: 460 (syn.).

1910. *Uranotaenia ceylonica* Theobald, Monog. Cul. World 5: 503–505. *Type:* F; Galle, Ceylon (B. Fletcher) [BMNH].—1913. Edwards, Bul. Ent. Res. 4: 238 (syn.).

1914. *Uranotaenia propria* Taylor, Roy. Ent. Soc. London, Trans. 61(1913): 704–705. *Type:* M; Townsville, Queensland (H. Priestley) [Sydney Univ.?].—1922. Edwards, Indian Jour. Med. Res. 10: 460 (? syn.).—1924. Edwards, Bul. Ent. Res. 14: 357–358 (syn.).

1919. *Uranotaenia cairnsensis* Taylor, Linn. Soc. N. S. W., Proc. 43: 839. *Type:* 2F; Cairns, Queensland, July 1917 (F. H. Taylor) [Sydney Univ.?].—1924. Edwards, Bul. Ent. Res. 14: 357–358 (syn.).

1934. *Uranotaenia atra* Theobald. Barraud, Fauna Brit. India. Diptera v.5 Family Culicidae, Tribes Megarhinini and Culicini pp. 72–74 (Fig.: M legs p. 73, clasper p. 79; larval head, comb plate, pecten teeth p. 58).

1935. *Uranotaenia atra* Theobald. Baisas, Philip. Jour. Sci. 57: 65–66 (Fig.: M

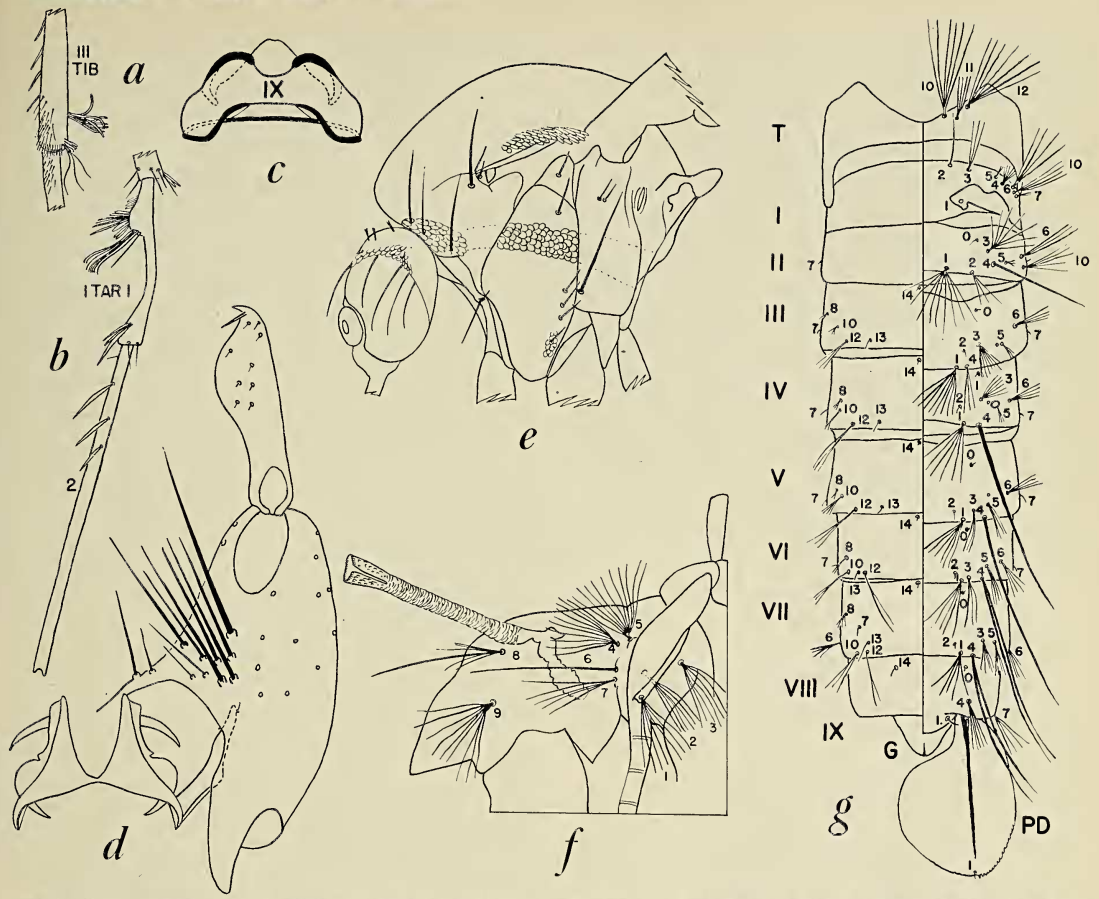

FIG. 1. *Uranotaenia atra* Theobald, 1905. *a–e*, Adult; *f*, *g*, pupa. *a*, *b*, Details of pro- and mesothoracic legs of male; *c*, ninth tergite of male; *d*, male genitalia; *e*, left lateral aspect of head and thorax of female; *f*, right lateral aspect of anterior portion of cephalothorax of pupa; *g*, metanotum and abdomen of male pupa, left ventral, right dorsal. Abbreviations as given on page 314.

fore leg, sidepiece, clasper; larval head and antenna).

1944. *Uranotaenia atra* Theobald. Knight, Bohart, and Bohart, Keys Mosq. Australasian Reg. pp. 16, 68.

Diagnosis

ADULT.—Head dark centrally; broad orbital line of azure-blue scales; frontal tuft undeveloped. Short supra-alar line of azure-blue scales; *apn* and *stp* each with broad patch of azure-blue scales, not markedly in line. Tarsi dark, without definite white on hind leg. Wing scales all dark. Abdomen with inconspicuous apicolateral white patches, invisible from above. *Male:* I Tar 1 shortened, expanded, excavated and with tufts of specialized scales; I Tar 2 with specialized scales; III Tib with apical and subapical tufts of specialized scales.

PUPA.—Trumpet length 12.0 median width; tracheoid extending to 0.75; uniformly dark; slit in meatus. Hair 8-C with central stem and short basal branches. Hair 2-III laterad or cephalad of 1-III. Hairs 4-IV, V single, distinctly longer than following two tergites. Hairs 6-I, II moderate in length. Cephalothorax without strongly contrasting dark ventral pigmentation.

LARVA.—Head about as wide as long; hairs 5, 6-C weak spikes; 4-C short 2, 3b; 7-C 2, 3b; 9-C long, strong, 2, 3b; 1-C short, stout. Antennal hairs simple; 1-A near base, short. Thorax and abdomen with well-developed ventral and dorsal stellate hairs with even

branches; hairs moderately long. Thoracic hairs 9, 10-P well developed; 9-M, T, 8-M, and 7-T long multiple, barbed; 4-P 2b; 7-P single; 14-P single; all hairs apically attenuated. Abdominal hairs 6-III–VIII stellate, much shorter than 6-I, II, without tubercles; 1-I, II 4–6b; 6-I, II 2b, branches uneven; 6-III, IV 5–7b. Comb plates separate; scales fringed. Siphon index about 4.0; pecten extending to 0.5; pecten teeth fringed apically and laterally; hair 1-S moderate, 7–11b, uneven; valves short; hair 9-S a slender hair, 13-S moderate, twisted at base. Anal segment short; saddle margin with small apical spicules; gills about 0.3 of saddle length, rounded; hair 1-X 6–10b, long; 2, 3-X 2b; 4ab-X 2, 3b.

Description

FEMALE (969–109).—Wing: 1.70 mm. Abdomen: 1.20 mm. Proboscis: 1.17 mm. Front femur: 1.33 mm.

Head: Frontal tuft not developed, a few slightly elongate azure-blue scales projecting anteriorly; orbital line of azure-blue scales broad, slightly expanded toward *apn;* decumbent dark scales iridescent bronzy; two pairs of erect, slender, apically forked, dark vertical scales; three pairs of slightly shorter, similar erect occipital scales; occipitals 1:3. Clypeus brown. Palpus about 0.06 of proboscis; scales inconspicuous, hairs very conspicuous, over 2.0 length of palpus. Proboscis slightly swollen apically; dark-scaled, lighter below; hairs short and inconspicuous except at apex; labella lighter, moderately hairy. Antenna about 1.2 of proboscis; torus creamy except for brown dorsomesal area, with short hairs and several minute, outstanding, dark broad scales; base of first flagellar segment creamy, remainder very dark brown; flagellar whorls with 6 long bristles; penultimate segment slightly longer than preceding, apical about 1.2 of penultimate.

Thorax: Scutal integument rather uniformly brown; dense vestiture of recumbent, narrow, curved, golden-brown scales; broad patch of semierect azure-blue scales in front of wing root, scales short anteriorly becoming elongate and lanceolate caudally and forming a conspicuous tuft; acrostichals moderate, other bristles strong, all dark. Scutellum brown; median lobe moderately prominent, with three strong bristles; lateral lobe with one weak and two strong bristles; scales dark, bronzy brown, dense. Pleural integument dark brown in middle, lighter in line with scaling and above and below; scaling and chaetotaxy as figured; *apn* with large patch of oval azure-blue scales, not forming a tuft caudally; *stp* with a large transverse patch of very broad, almost circular, azure-blue appressed scales; small patch of translucent light scales on lower *stp;* bristles dark, propleurals weak. Haltere light on base and lower part of stem, dark-scaled on upper part of stem and knob.

Wing: Distance between crossveins about equal or slightly less than *m-cu.* Vein R_2 about 0.30 of R_{2+3}; vein M_{1+2} about 0.68 of M beyond *m-cu.* All scales dark, fringe lighter.

Legs: Coxae and trochanters creamy; scales light and translucent, with a faint bluish iridescence. Femora dark above, lighter ventrally, creamy at base. Tibiae and tarsi dark above, somewhat lighter below. Leg I: femur 1; tibia 1.0; tarsus 0.63, 0.43, 0.30, 0.13, 0.09; claws very large. Leg II: femur 1.07; tibia 1.43; tarsus 0.80, 0.40, 0.26, 0.12, 0.10. Leg III: femur 1.11; tibia 1.25, enlarged apically; tarsus 1.05, 0.62, 0.42, 0.25, 0.10, segment 1 with a small tuft of scales at base ventromesally.

Abdomen: Tergite 1 with small lateral patch of white scales; tergites 2–7 with inconspicuous apicolateral patches of scales, invisible from above, on proximal segments patches reach to base of segments, on distal restricted to apical margin; remainder of tergites dark-scaled. Sternites light cream color, almost white.

MALE (969–102).—Wing: 1.50 mm. Proboscis: 1.16 mm. Front femur: 1.25 mm.

Generally very similar to female. Proboscis very strongly swollen apically, conspicuous ventral light patch on swollen part. Orbital

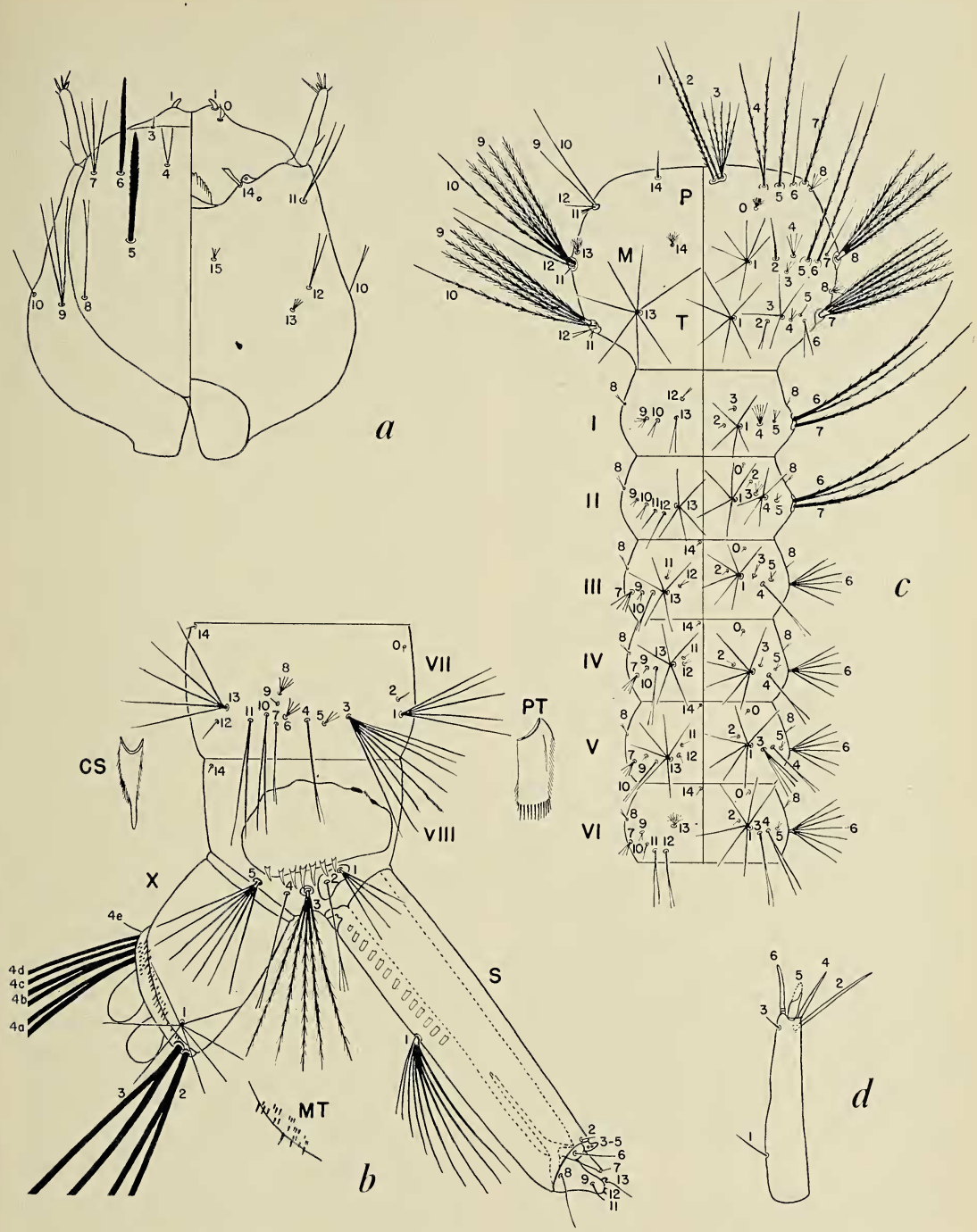

FIG. 2. *Uranotaenia atra* Theobald, 1905. Fourth instar larva. *a*, Head, left dorsal, right ventral; *b*, left lateral aspect of distal abdominal segments; *c*, thorax and proximal abdominal segments, left ventral, right dorsal; *d*, dorsal aspect of left antenna. Abbreviations as given on page 314.

line of light scales narrower than in female. Torus and flagellum dark brown; flagellar whorls with about 12–14 bristles, about 0.23 of flagellar length; penultimate segment 1.25 of preceding, apical 1.50 of penultimate. Leg I: femur 1; tibia 1.0; tarsus 0.28, 0.53, 0.40, 0.20, 0.06, segment 1 shortened, excavated and with specialized bristles as figured, segment 2 with specialized bristles as figured; claws equal, one markedly swollen. Leg II: femur 1.05; tibia 1.50; tarsus 0.64, 0.33, 0.25, 0.06, 0.18, segments 4 and 5 as illustrated by Barraud (1934), segment 4 with a long ventral lobe extending to almost middle of 5, segment 5 with small median ventral lobe; claws enlarged, larger claw forked. Leg III: femur 1.13; tibia 1.22, subapical and apical tufts of specialized scales as illustrated; tarsus 1.02, 0.64, 0.44, 0.17, 0.11; claws equal, not markedly different.

MALE GENITALIA (969–102).—As figured. Ninth tergite widely and deeply emarginate proximally, sclerotization evanescent in the middle; apex narrowly but deeply emarginate; lateral lobe wide, with apical sclerotization extended ventrolaterally proximad as a strong curved bar. Proctiger without distinct sclerotizations. Basal lobe of sidepiece with dorsal group of six strong and several small bristles, and one large and one small bristle ventrally. Clasper as illustrated. Mesosome with narrow basal dorsal bridge only; apical tooth long, weakly curved, three serrations near its base on apex of mesosome plate; median tooth broad at base, strongly incurved, one serration near its base distally on mesosome plate. Paramere moderately expanded near base.

PUPA (Exuviae of female, 969–109).—Abdomen: 1.80 mm. Trumpet: 0.63 mm. Paddle: 0.47 mm.

Cephalothorax: Dark pigmentation of apical portion of wing cases and midventral line including all of leg cases contrasting sharply with the lighter pigmentation of the remainder, except for darker areas at base of wing cases, middorsally on mesonotum and laterally on metanotum. Trumpet dark throughout; length 12.0 median width; widened in basal 0.25, slightly flared in apical 0.25; inner wall indistinct except in reticulate; tracheoid extending to about 0.75, well developed mesally except on apex, absent from basal 0.08; reticulate indistinctly ornamented; pinna 0.04; distinct mesal slit in meatus extending about 0.13 of trumpet length. Hairs moderately pigmented; relative position, length, and degree of development as figured; larger branched hairs with long slender basal stalk moderately expanded apically where branches arise, outer branches often shorter, longer branches with small but distinct barbs. Hairs: 1(5, 9b, outer branches of latter shorter), 2(5, 6b), 3(7b), 4(9b), 5(11b), 6(1), 7(5, 6b), 8(5, 6b, one branch greatly elongated and thickened), 9(10b), 10(6, 7b), 11(3b), 12(7, 9b).

Abdomen: Moderately pigmented and with dark areas midlaterally and intersegmentally, VIII and IX almost completely dark; tergites II–VII each with a posteromedian patch of distinct small spicules becoming more extensive caudally; tergite VIII with median patch of shorter, stronger spines arranged in small groups; tergal reticulations indistinct; sternites III–VII each with extensive median patch of small spicules; sternite II without transverse band; sternite VIII with large anteromedian patches of spicules similar to those of tergite. All hairs moderately pigmented; relative position, length, and degree of development as figured; larger hairs as on cephalothorax. Segment I: hair 1(14 primary branches, strongly barbed, secondary branching strong, also with barbs, about 1.1 length of segment), 2(1), 3(3b), 4(7b), 5(5, 7f),6(4b), 7(2f), 10(4b). Segment II: hair 0(1), 1(10b), 2(3b), 3(1), 4(6, 7b), 5(4b), 6(2, 3b), 7(1), 10(4b). Segment III: hair 0(1), 1(8, 10b), 2(1), 3(8b), 4(3, 4b), 5(3, 5f), 6(5b), 7(1), 8(3f), 10(4b), 12(3b), 13(1), 14(1). Segment IV: hair 0(1), 1(7b), 2(1), 3(6b), 4(1, minutely barbed distad), 5(3, 4f), 6(5b), 7(1), 8(5b), 10(2, 3f), 12(3b), 13(1), 14(1). Segment V: hair 0(1), 1(5b), 2(1), 3(3b), 4(1, minutely barbed distad), 5(4, 5b), 6(5b), 7(1), 8(4b),

10(4b), 12(3b), 13(1), 14(1). Segment VI: hair 0(1), 1(5b), 2(1), 3(3, 4b), 4(2b, minutely barbed distad), 5(5b), 6(4, 5b), 7(1), 8(4f), 10(3b), 12(2b), 13(1), 14(1). Segment VII: hair 0(1), 1(4, 5b), 2(1), 3(6b), 4(2b, minutely barbed), 5(4b), 6(3, 4b), 7(1), 8(3, 4b), 10(2, 3b), 12(2b), 13(1), 14(1). Segment VIII: caudal margin of sternite truncate; hair 0(1), 4(5b), 7(4, 5b), 14(1). Segment IX: hair 1(1; 0.6 of segment length). Paddle as figured; lightly pigmented; midrib strongly sclerotized, evanescent apically; external buttress faintly indicated proximally; basal pigment bar distinct; external margin with distinct serrations on apical 0.30; internal margin with a few scattered sharp spines apically; hair 1 small, distinct. Genital lobe extending to 0.20 of paddle; with ventroapical patch of strong short spicules. Anal segment indistinct; cercal sclerites not defined. Male genital lobe (exuviae of 969–102) extending to 0.30 of paddle, ventral spines arising from weak imbrications; anal segment indistinct.

LARVA (Fourth instar exuviae of female, 969–109).—Head: 0.60 mm. Siphon: 0.57 mm. Anal saddle: 0.25 mm.

Head: Width about equal to length; ocular bulge not distinctly defined; pigmentation light except in antennal and postocular areas; integumentary imbricate sculpturing faint anteriorly, distinct caudally. Labrum long, 0.4 of width at 1-C, anterior margin emarginate to one half of length. Mental plate moderate; with six teeth on each side, apical one more prominent; median apical portion with three teeth, separated from remainder. Hairs of head capsule moderately pigmented, well developed; 5, 6-C developed into thin spikes, lighter in color than usual, apices sharply pointed, shafts spiculate basally becoming barbed apically; 7, 9, 11-C minutely barbed, other hairs simple; relative position, length, and degree of development as figured. Hair 0(1, short, leaf-like), 1(1, short, stout, bluntly rounded apically), 3(1, moderate in length), 4(3b), 5(1), 6(1), 7(3b), 8(1, 2f), 9(3b), 10(1, 2f), 11(3b), 12(2, 3f), 13(4b), 14(1, irregular, lightly pigmented spine), 15(2, 3b). Antenna 0.20 of head; shaft distinctly narrowed at about 0.5; width at middle 0.18 of length; uniformly moderately pigmented except at extreme base; shaft without spicules. Antennal hairs well pigmented except 1-A; relative position, length, and degree of development as figured; all single; 1-A placed at 0.18–0.27, length 1.1 of antennal width.

Thorax: Long hairs and tubercles strongly pigmented; short hairs and stellate hairs lightly pigmented; relative position, length, and degree of development as figured; apices of long hairs attenuated; barbs when present long, slender, but conspicuous; hair 5-P about as long as head. Prothorax: hair 0(8, 10d, b), 1(1), 2(1), 3(5b, branches strongly barbed, base elongate, somewhat expanded apically), 4(2b), 5(1), 6(1), 7(1), 8(4b), 9(1), 10(1), 11(3, 4b), 12(2f), 14(1, densely and minutely spiculate). Mesothorax: hair 1(9b), 2(1), 3(3, 4b), 4(4b), 5(1), 6(1), 7(1), 8(4, 5b), 9(4b), 10(1), 11(2, 3b), 12(1), 13(19, 20d), 14(16d). Metathorax: hair 1(6, 7b), 2(2f), 3(4b), 4(3b), 5(1), 6(2b), 7(7b), 8(10, 12d), 9(4b), 10(1), 11(2b), 12(2f), 13(7b).

Abdomen: Tubercles and hairs 6, 7-I, II strongly pigmented, other hairs moderately pigmented; relative position, length, and degree of development as figured; barbs when present slender, inconspicuous. Stellate hairs (1, 6, 13) with equal branches; 4-II a stellate hair. Segment I: hair 1(4, 6b), 2(1), 3(1), 4(7b), 5(4b), 6(2b, lower branch shorter), 7(1), 8(2, 3f), 9(4, 6b), 10(3f), 12(3b), 13(2b). Segment II: hair 0(1), 1(6b), 2(1), 3(4, 6b), 4(5b), 5(1, 3f), 6(2b, lower branch shorter), 7(1), 8(2f), 9(3b), 10(2b), 11(2f), 12(1), 13(4, 5b). Segment III: hair 0(1), 1(6, 7b), 2(1), 3(2f), 4(2f), 5(2, 3b), 6(6b), 7(4, 5b), 8(2f), 9(1), 10(2f), 11(2f), 12(1, 2b), 13(4, 5b), 14(1). Segment IV: hair 0(1), 1(6b), 2(1), 3(1, 2f), 4(2, 3f), 5(2b), 6(6, 7b), 7(3b), 8(2f), 9(1), 10(2b), 11(1), 12(2b), 13(5, 6b), 14(1). Segment V: hair 0(1), 1(7b), 2(1), 3(3b), 4(2f), 5(2b), 6(6b), 7(5b), 8(2b), 9(1, 2f), 10(1, 2f), 11(1), 12(2b), 13(6b), 14(1). Seg-

ment VI: hair 0(1), 1(7b), 2(1), 3(2, 3f), 4(3b), 5(1, 2b), 6(7b), 7(4b), 8(2, 3f), 9(2b), 10(2f), 11(2b), 12(2f), 13(16, 17d), 14(1, 2f). Segment VII: hair 0(1), 1(6, 7b), 2(1), 3(6, 9b), 4(2f), 5(2, 3b), 6(5b), 7(2f), 8(5, 6b), 9(1, 2f), 10(2b), 11(3b), 12(1), 13(5b), 14(1). Segment VIII: comb plate strongly sclerotized, moderately pigmented, ornamented with numerous imbrications but lacking spicules except apically; comb scales 7–8, ventral ones smaller, sharply pointed, with short lateral fringe extending to about 0.75 as figured; hair 0(1), 1(4, 5b, outer branches shorter), 2(2, 3f), 3(4b), 4(2f), 5(7b, outer branches shorter), 14(1, unusually strong). Siphon: as figured; length 4.0 median width; moderately pigmented, imbrications as on comb plate but all without spicules; pecten extending to 0.5, teeth 11–12, with lateral and apical fringe as figured; valves as figured, very darkly pigmented, ventral valve short; hair 1(9, 10b, outer branches shorter, basal expansion short and asymmetrical, barbs absent), 2(1, unusually long), 3–5 (only two setal rings visible), 6(1, strong, longer than valve), 7(1, short, slender), 8(1, moderate, shorter than valve), 9(1, long but very slender and attenuate), 10(hairless setal ring), 11(1, well developed), 12(1, minute), 13(1, strong, twisted at base, about length of valve). Segment X: saddle lightly pigmented, darker on the apex dorsally; median width 0.8 of length; imbrications much fainter than on comb plate except caudally; caudal margin without long teeth, but with several rows of small spicules arising from imbrications; gills short, stubby, rounded apically, about 0.3 of saddle length; hair 1(7, 10b, about 0.45 of saddle length), 2(2b, about 3.2 of saddle length), 3(2b, about 3.8 of saddle length), 4a(2b, about 1.3 of saddle length), 4b(2b, about 2.0 of saddle length), 4c(1, about 2.4 of saddle length), 4d(1, about 1.6 of saddle length), 4e(1, about 0.25 of saddle length).

Variation

The adults of *U. atra* show considerable variation in the amount and intensity of blue scaling on the head and the thorax as do the other ornamented species, but in all the specimens the azure-blue iridescence is very distinct. The white scaling of the abdominal tergites is also subject to considerable individual variation but is never absent.

The variation in the chaetotaxy of the immature stages is summarized in Tables 1 and 2. The range of variation of branching in this species appears to be less than in any other species known from the Solomons, but this may be due to the fact that only three collections were made and from only two localities on Guadalcanal. One larval specimen shows a duplication of hair 1-C on the left side, another has 2-A placed at about the middle of the antenna instead of the apex.

No information is available on geographical variation in the Solomon Islands. A single male from Munda, New Georgia, agrees in all respects with the material from Guadalcanal.

Specimens examined: 27M; 28F; 81P; 27L. Individual rearings: 16 larval, 1 pupal.

Taxonomic Discussion

The application of the name *Uranotaenia atra* to the ornate species with the characteristically modified male front tarsus, entirely dark legs, and largely dark abdomen rests on Edwards' identification (1913: 238) of Theobald's "mouldy and rubbed and scarcely recognizable" single female type specimen of *U. atra* as conspecific with *U. ceylonica* Theobald, 1910, another species described from a single female specimen. Later Edwards (1922: 460) synonymized *U. coeruleocephala lateralis* Ludlow, 1905, based on four females from the Philippines, and *U. cancer* Leicester, 1908, based on a male and a female from the Malay Peninsula. Still later (1924: 357–358) Edwards synonymized *U. propria* Taylor, 1914, based on a male from Queensland, and *U. cairnsensis* Taylor, 1919, based on two females also from Queensland.

The species as understood by Edwards could hardly be recognized from Theobald's de-

scription of *U. atra* (1905: 114; 1907: 563–564), but the remaining nominal species are evidently applicable to the same species or species complex in different portions of its range. It is possible that the poor original condition of the type female of *U. atra* is responsible for Theobald's failure to mention the characteristic ornamentation of the head, pleura, and abdomen and the absence of white scales on the wing. On the other hand it is also possible that *U. atra* Theobald represents a species distinct from Edwards' concept and one which has not been recognized since the original description. Theobald's description fits *U. annandalei* Barraud, 1926, much better than any other species, but *U. annandalei* has not been reported to date from New Guinea although it is known from the Philippines (Baisas, 1935: 64). For the present I prefer to follow Edwards' synonymy and to retain the name *U. atra* Theobald, 1905, for this species.

The reportedly wide geographical distribution of *U. atra* in the Oriental and Australasian regions leads one to suspect that it may break up into a number of geographical subspecies or that it may be a complex of related species. The more or less detailed descriptions of the adults from India, Ceylon, Malaya, Philippines, and Australia agree quite well in general features with the specimens from Guadalcanal. I find small differences, apparently constant, in the foreleg of the males from the Solomons when compared with the descriptions and figures of Philippine and Indian material. The larvae from Guadalcanal are quite distinct from those described from India (Barraud, 1934: 74) and Netherlands East Indies (Bonne-Wepster and Brug, 1939: 1231; Brug, 1924: 441–442) in the length of the siphon (Solomons 4:1, others 3:1 or less), and in addition there appear to be constant differences in chaetotaxy which cannot be determined positively without a study of large series. Baisas (1935: 65) states that the Philippine *U. atra* breeds in forest streams, an ecological niche different from that occupied by this species in other portions of its range where apparently it is confined to coastal swamps and to crab holes. The pupal stage has not been previously described.

Although it appears likely that *U. atra* splits at least into several geographical subspecies, I consider that our present knowledge is insufficient to recognize these forms. As pointed out above, the name *U. atra* is associated with the complex under consideration on rather inconclusive evidence. As far as I have been able to determine, neither *U. atra* sensu Edwards (other than the single female of Theobald) nor *U. annandalei* have been collected on New Guinea. Until such collections are made and studied and the types compared again, it would be unwise to introduce new names in a species complex which has more names already associated with it than any other *Uranotaenia*.

It appears that *U. atra* is most closely related to the *tibialis*-group and to other species with modified fore tibia and tarsus, as well as to *U. annandalei* which shares with this group the peculiar leaf-like development of the antennal hairs of the larva. The adults of these species have very broad scales on the pleura arranged in broad patches and usually showing very strong azure-blue iridescence. In the Oriental and Australasian regions the known pupae of all these species have extremely elongate slender respiratory trumpets, greatly elongated hairs 4-IV, V, and a peculiar development of hair 8-C. On the other hand *U. atra* is quite distinct from all its nearest relatives in having a larva with a wide head, poorly developed spike hairs, very short hairs 1-C, unmodified antenna, and very short anal gills.

Biology

The three larval collections on Guadalcanal were all made in slightly brackish-water pools immediately back of the beach in open sunlit areas. Thorough collections in other *Uranotaenia* breeding areas never revealed this species. It appears to be restricted on Guadalcanal

to the same ecological niche as *Culex sitiens* Wiedemann, 1828, another species with short hair 1-C and stubby anal gills, characters apparently associated with a brackish-water habitat. The only other species found associated with *U. atra* on Guadalcanal was *Anopheles farauti* Laveran, 1902.

Living larvae are paler than those of other species inhabiting ground pools and can be immediately recognized in the field by the extremely short anal gills. The pupae are easily recognized in the field by the entirely dark, very elongate slender trumpets.

This species has been reported breeding in crab holes and stagnant pools or swamps with nipa palms in Malaya (Leicester, 1908: 217), in brackish water on a coral islet in Java (Brug, 1924: 442), and in forest streams in the Philippines (Baisas, 1935: 65).

The adults of this species were not collected on Guadalcanal and there is no published account of their habits.

Distribution

SOLOMON ISLANDS, *Guadalcanal*: mouth of Lunga River (79–1) Dec. 3, 1943 (M. Cohen); mouth of Balasuma River (968–3, 969–1) Apr. 30 and May 5, 1945 (JNB *et al.*) [USNM, CU, JNB]. *New Georgia:* Munda, 1944, 1M (J. G. Franclemont) [JNB].

TERRITORY OF NEW GUINEA, *Madang:* Muina (Muima, near Madang) 1900 (Biro) [Budapest. Magyar Nemzeti Muzeum. (Theobald, 1901)].

AUSTRALIA, *Queensland:* Cairns, July, 1917 (F. H. Taylor); Townsville (H. Priestley) [Sydney Univ.? (Taylor, 1919)].

NETHERLANDS EAST INDIES, *Java:* Edam Islet, Bay of Batavia (S. L. Brug) [Weltevreden, Java. Centraal Militair Geneeskundig Lab. (Brug, 1924)].

PHILIPPINE ISLANDS, *Mindanao:* Cottabato, June 25, 1905 (E. B. Vedder) [USNM (Ludlow, 1905)]. *Palawan:* Iwahig (F. E. Baisas). *Luzon:* Laguna, Calauan (Santiago); Bulacan, Tungcong Manga, San Jose (F. E. Baisas) [Manila. Dept. Health (Baisas, 1935)].

INDIA, CEYLON, ANDAMAN ISLANDS, MALAY PENINSULA, SIAM

2. *Uranotaenia barnesi* Belkin n. sp.
Plates 3, 4

1944. *Uranotaenia tibialis* Taylor. Knight, Bohart, and Bohart, Keys Mosq. Australasian Reg. p. 15 (*partim*).
1947. *Uranotaenia* sp. King and Hoogstraal, Ent. Soc. Am., Ann. 39: 593.

Diagnosis

ADULT.—Head dark in small triangular central area; very broad orbital line of light azure-blue scales; frontal tuft undeveloped. Moderately long and broad supra-alar line of light azure-blue scales; *apn* and *stp* each with moderately broad patch of light azure-blue scales, not distinctly in line. Hind tarsus white-scaled from extreme apex of segment 2. Wing white-scaled on base of R, Cu, and 1A. Abdominal tergites completely dark-scaled. *Male:* I Tib with long apical tuft of scales; I Tar 1 with long specialized bristles and scales at base; I Tar 2 with large tuft of specialized scales beyond middle.

PUPA.—Trumpet length 13.0 median width, tracheoid extending to 0.55; dark on tracheoid and apex, light in between; slit in meatus. Hair 8-C with central stem and short basal branches. Hair 2-III laterad or cephalad of 1-III. Hairs 4-IV, V 2–5b, shorter than two following tergites. Hairs 6-I, II very long and conspicuous. Cephalothorax with strongly contrasting dark ventral pigmentation.

LARVA.—Head slightly longer than wide; hairs 5, 6-C strong spikes; 4-C long, simple; 7-C 1–3b; 8-C strong, 2, 3f; 9-C short 4–7b. Antennal hairs 2–4 leaf-like, 2, 3-A removed from apex; 1-A short, simple. Thorax and abdomen with very short dorsal and ventral stellate hairs with even branches; all hairs short. Thoracic hairs 9, 10-P very short; 9-M, T, 8-M, 7-T long, multiple, barbed; 4-P 2b; 7-P single; 14-P single; 1, 2-P and 5-M with apex frayed or brush-like. Abdomi-

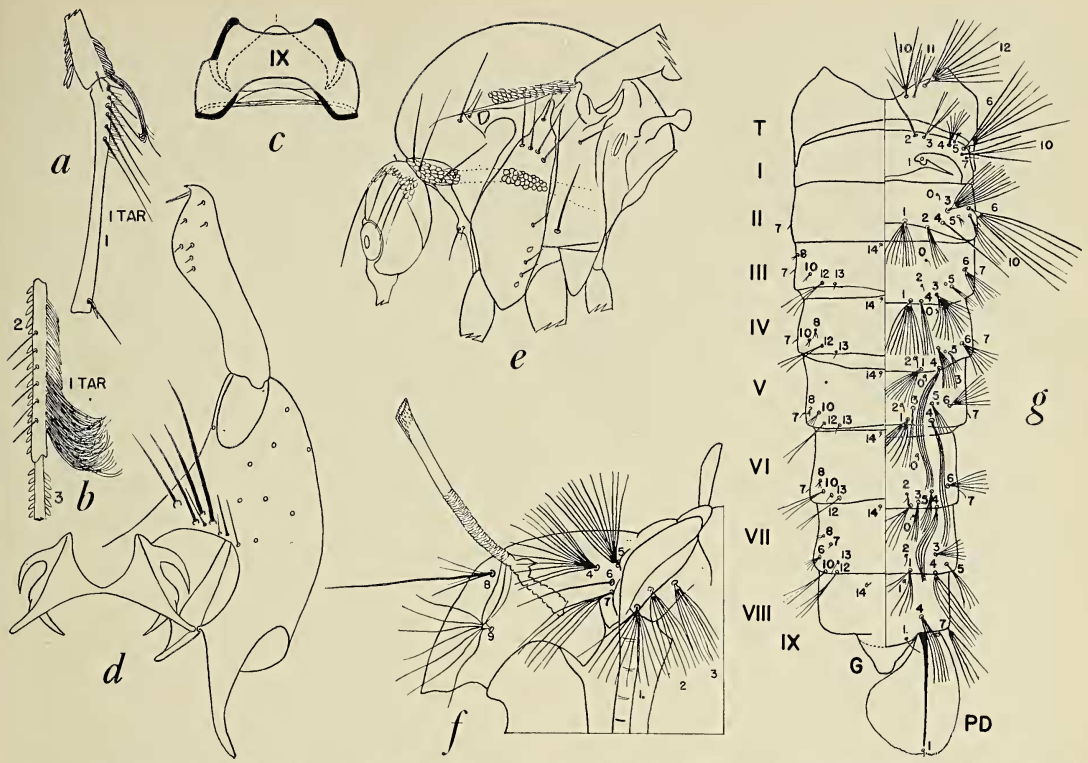

FIG. 3. *Uranotaenia barnesi* Belkin n. sp. *a–e*, Adult; *f*, *g*, pupa. *a*, *b*, Details of prothoracic leg of male; *c*, ninth tergite of male; *d*, male genitalia; *e*, left lateral aspect of head and thorax of female; *f*, right lateral aspect of anterior portion of cephalothorax of pupa; *g*, metanotum and abdomen of male pupa, left ventral, right dorsal. Abbreviations as given on page 314.

nal hairs 6-III–VIII stellate, much shorter than 6-I, II, without tubercles; 1-I, II 4–6b; 6-I, II 3b, branches even; 6-III, IV 6–9b. Comb plates separate; scales fringed. Siphon index about 3.5; pecten extending to 0.5; pecten teeth apically fringed; hair 1-S short, 10–13b; valves very long; hair 9-S weak, not hook-like; hair 13-S very long, strongly twisted at base. Anal segment very long; saddle margin with short apical spines; gills about 0.7 of saddle length; hair 1-X usually 5b; 2-X 4, 5b; 3-X 2b; 4a, b-X 2b.

Description

FEMALE (624–24).—Wing: 1.67 mm. Abdomen: 1.00 mm. Proboscis: 1.17 mm. Front femur: 1.20 mm.

Head: Vertex with decumbent scales all broad and rounded apically, no frontal scale tuft; a very broad orbital line of light azure-blue scales to level of *apn* where it is distinctly enlarged, leaving a smaller dorsocentral dark-scaled area; one pair of slender, dark erect occipital scales; one supernumerary frontal; occipitals all present, 1:3. Clypeus dark brown. Palpus about 0.05 of proboscis; with minute dark scales and numerous dark hairs, some 1.5 or more length of palpus. Proboscis distinctly swollen apically; dark-scaled throughout; swollen portion with long hairs; labella light brown, moderately hairy. Antenna about 1.2 of proboscis; torus brown, a few short hairs dorsally and longer hairs mesally; flagellum darker, five or six bristles in whorls; hairs and scales scanty basally, becoming more numerous apically; apical segment with long light hairs, about 1.4 length of penultimate.

Thorax: Scutal integument dark brown with lighter longitudinal areas; sparse vestiture of

recumbent narrow, elongate golden-brown scales; supra-alar line of light azure-blue scales as figured, anterior scales small, almost circular in outline, becoming more elongate caudally, posterior scales narrow; acrostichals weak, other scutal bristles strong, all dark, supra-alars few in number. Scutellum brown, median lobe very prominent; median lobe with three strong bristles, scales short, rounded, projecting only slightly over base of bristles; lateral lobes each with one weak and two strong bristles, scales elongate, projecting strongly over bases of bristles. Postnotum brown, darker centrally. Pleural integument light brown; scaling and chaetotaxy as figured; scales light azure-blue on *apn* and middle sternopleuron, patches in line with light-scaling of head and a light integumentary area caudad of *apn;* scales of *apn* short, rounded anteriorly, elongate, pointed in small caudal patch; scales of middle sternopleuron smaller, almost circular in outline; scales on lower sternopleuron practically transparent; larger bristles dark, shorter, golden brown. Haltere light on base, darker on stem distally, knob dark-scaled.

Wing: Distance between crossveins 1.7 of *m-cu*. Vein R_2 about 0.4 of R_{2+3}; vein M_{1+2} about 0.6 of M beyond *m-cu*. White scales dorsally on caudal margin of R to slightly beyond arculus, on basal 0.3 of Cu, and on base of 1A; remaining dorsal scales dark, much darker on costal and radial fields, iridescent bronzy.

Legs: Coxae light, with few translucent scales and light hairs and bristles; trochanters light, with a few hairs; femora dark-scaled above, lighter below; tibiae entirely dark-scaled; front and mid tarsi entirely dark-scaled, appearing lighter ventrally in some lights; hind tarsus white-scaled on entire segments 3–5 and the extreme apex of 2. Leg I: femur 1; tibia 1.0, with small tuft of specialized scales and elongate bristles; tarsus 0.85, 0.50, 0.36, 0.14, 0.07; claws equal, one thickened, other elongate. Leg II: femur 1.14, moderately swollen; tibia 1.70, with three short stout bristles apically; tarsus 0.90, 0.53, 0.30, 0.09, 0.09; claws as on I. Leg III: femur 1.30, very slender; tibia 1.30, with specialized scales on swollen apex; an inconspicuous light patch subapically on external face; tarsus 1.20, 0.60, 0.40, 0.20, 0.10; claws minute.

Abdomen: Tergites completely dark, scales iridescent bronzy; sternites light-scaled, contrasting sharply with tergites, especially basally.

MALE (921–301).—Wing: 1.75 mm. Proboscis: 1.33 mm. Front femur: 1.10 mm.

Generally very similar to female. Vertex of head more extensively dark-scaled, orbital light line narrow dorsally, more conspicuously enlarged laterally to *apn*. Proboscis more strongly swollen apically. Flagellar whorls about 0.28 of flagellum, with about 12 bristles. Light-scaling on wing indistinct, dingy white. Leg I: femur 1; tibia 0.92, specialized bristles on apex as figured; tarsus 0.54, 0.40, 1.10, 0.40, 0.12, specializations as figured; claws equal, one strongly swollen. Leg II: femur 1.28, strongly swollen; tibia 1.90; tarsus 0.92, 0.66, 0.23, 0.06, 0.17, segment 4 with long ventral lobe projecting below base of 5; claws enlarged, shorter claw about 0.9 of larger and more slender, slightly curved; larger claw strongly curved. Leg III: femur 1.38; tibia 1.52; tarsus 1.42, 0.78, 0.53, 0.28, 0.13; claws as on foreleg.

MALE GENITALIA (921–301).—As figured. Ninth tergite expanded, without bristles; proximal part strongly emarginate in the middle and with sclerotization evanescent; apical part more shallowly emarginate, poorly defined, short, broad lateral lobe; a strong ventrolateral sclerotization from apex of lateral lobe toward basal arm of sidepiece. Proctiger with weak lateral sclerotizations. Basal lobe of sidepiece with a dorsal group of three large and one small specialized bristles arising from tubercles, ventrally with one specialized long bristle arising from a tubercle. Clasper as figured, apex of spine broken off. Mesosome with a poorly sclerotized ventral bridge in addition to strongly sclerotized dorsal bridge;

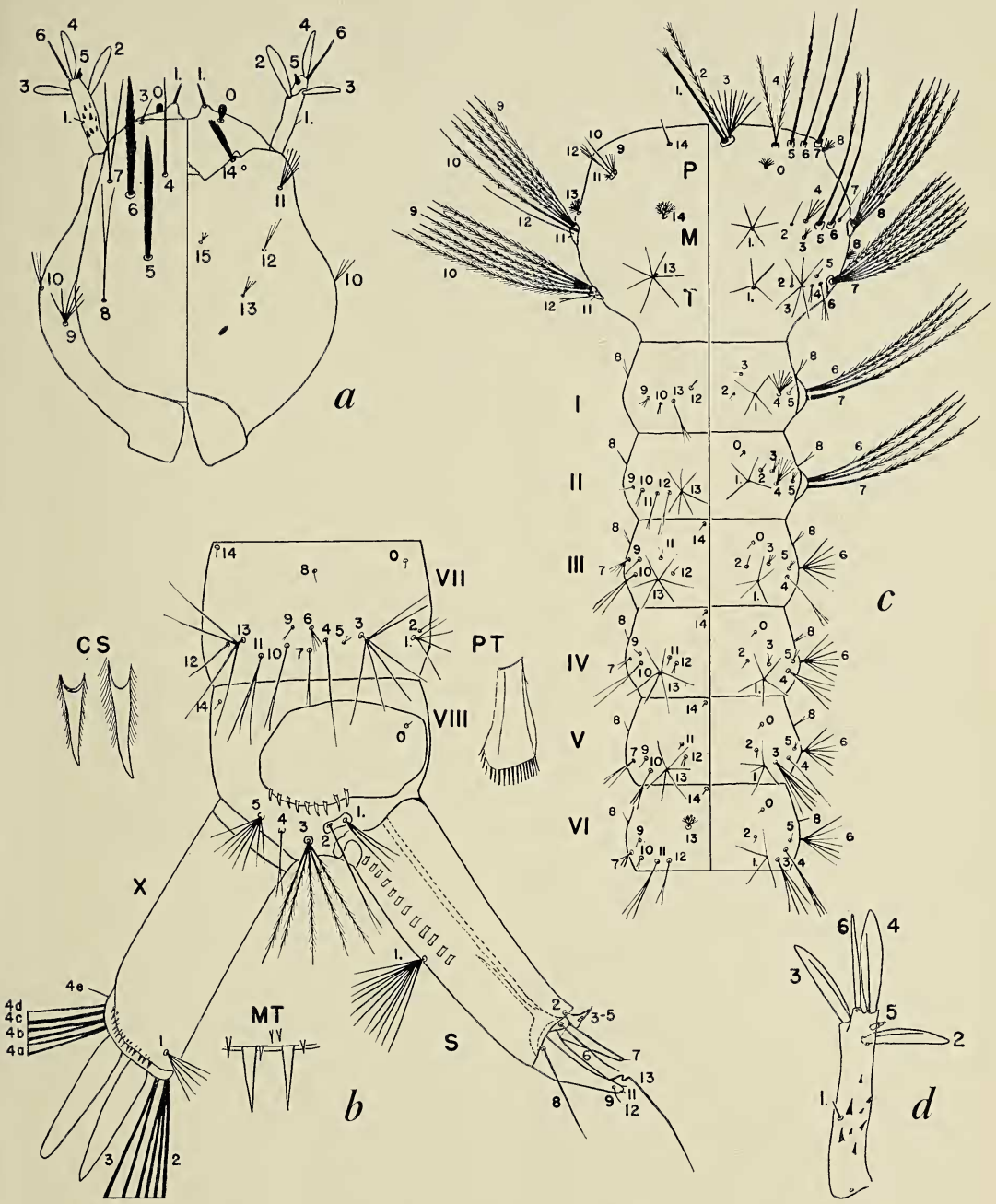

FIG. 4. *Uranotaenia barnesi* Belkin n. sp. Fourth instar larva. *a*, Head, left dorsal, right ventral; *b*, left lateral aspect of distal abdominal segments; *c*, thorax and proximal abdominal segments, left ventral, right dorsal; *d*, dorsal aspect of left antenna. Abbreviations as given on page 314.

an apical and a median long spine curved ventrad on each lateral plate, spines subequal. Paramere moderately expanded in the middle.

PUPA (Exuviae of holotype, 624–24).—Abdomen: 1.65 mm. Trumpet: 0.60 mm. Paddle: 0.40 mm.

Cephalothorax: Dark pigmentation of apical portions of wing cases and mid-ventral line, including all of leg cases, contrasting very sharply with the light pigmentation of the remainder. Trumpet dark on tracheoid and apex of pinna, light in between and at base; length 13.0 median width; parallel-sided to about 0.6, then gradually slightly flared; inner wall indistinct except at apex; tracheoid extending to 0.55, absent from basal 0.1; reticulations absent, replaced by minute, sparse spicules; pinna about 0.05, opening almost circular; a distinct slit in meatus extending about one-half distance of reticulate. All hairs lightly pigmented and simple; relative position, length, and degree of development as figured; larger branched hairs, except 8-C, with base elongate proximally and moderately expanded distally where branches arise. Hairs: 1(9, 10b), 2(7, 8b), 3(7b), 4(14, 15b), 5(13, 14b), 6(1), 7(5, 7b, branches as distinct as in other hairs), 8(5, 6b, central stem long and heavy, basal branches short and slender), 9(6, 8b, branches as distinct as in other hairs, outer shorter), 10(6b, outer branches shorter), 11(5b), 12(8, 11b, outer branches shorter).

Abdomen: Lightly pigmented on I and II, progressively darker distad, except for caudolateral lighter areas on V–VII; tergites III–VII with a small posteromedian patch of short, heavy spicules; tergite II with a larger, more anterior patch; tergite VIII with large anteromedian patch of arcuately transverse lines of spicules; reticulations not visible; sternites II–VIII with extensive median patch of smaller spicules, arranged in transverse arcuate lines on more proximal segments. Hairs lightly pigmented on basal segments, darker caudally; relative position, length, and degree of development as figured; larger branched hairs with elongate basal stems which are not expanded into conspicuous plates distally. Segment I: hair 1(16, 18 primary branches with occasional apical secondary branches; about 1.2 length of tergite), 2(1), 3(4, 5b), 4(7, 8b), 5(2, 3f, heavy stem), 6(6, 7b), 7(1), 10(3b). Segment II: hair 0(1), 1(10, 11b), 2(4b), 3(11, 13b), 4(1), 5(3, 4f), 6(4, 5b), 7(1), 10(2, 3b). Segment III: hair 0(1), 1(8, 12b), 2(1), 3(12, 13b), 4(3, 4b), 5(3, 4b), 6(5, 6b), 7(1), 8(4, 5b), 10(2, 4b), 12(3, 4b, well developed), 13(1), 14(1). Segment IV: hair 0(1), 1(10b), 2(1), 3(7b), 4(3, 4b), 5(4b), 6(7b), 7(1), 8(3, 4b), 10(2f), 12(3, 4b), 13(1), 14(1). Segment V: hair 0(1), 1(7b), 2(1), 3(4b), 4(2, 3b), 5(6b), 6(6b), 7(1), 8(2, 3f), 10(5b), 12(3b), 13(1), 14(1). Segment VI: hair 0(1), 1(6b), 2(1), 3(4b), 4(4, 5b), 5(4b), 6(6, 7b), 7(1), 8(3, 4b), 10(3b), 12(2b), 13(1), 14(1). Segment VII: hair 0(1), 1(5, 6b), 2(1), 3(6, 7b), 4(5b), 5(4, 5b), 6(4, 5b), 7(1), 8(3b), 10(3b), 12(3b), 13(1), 14(1). Segment VIII: caudal margin of sternite truncate; hair 0(1), 4(6, 7b), 7(4, 5b), 14(1). Segment IX: hair 1(1, about 0.5 of segment length). Paddle as figured; lightly pigmented; midrib strongly sclerotized, evanescent apically; external buttress indistinct; basal pigment bar very dark; external margin with very short, blunt, indistinct serrations; internal margin with a few faint apical serrations; hair 1 short and indistinct. Genital lobe: extending to about 0.30 of paddle; ventrocaudal patch of spicules. Anal segment equal in length to genital lobe, slightly broader than the latter apically; cercal sclerites distinct. Male genital lobe (exuviae of allotype, 921–301) extending to 0.30 of paddle; pair of large ventral lateral patches of strong spines; anal segment with distinct basal sclerotization connected to genital lobe.

LARVA (Fourth instar exuviae of holotype, 624–24).—Head: 0.55 mm. Siphon: 0.42 mm. Anal saddle: 0.36 mm.

Head: Width 0.9 of length; ocular bulge very prominent, preocular area very strongly narrowed; pigmentation very light except for a transverse dark band in antennal region and another on posterior part of ocular bulge;

integumentary imbricate sculpturing distinct and uniform. Labrum short, 0.25 of width at 1-C, median emargination so deep that labrum appears as two prominent tubercles for 1-C. Mental plate small, with about 11 indistinct teeth. Dorsal hairs of head capsule strongly pigmented except for 8, 9, 10-C; ventral hairs lightly pigmented; 5, 6-C spike-like, very darkly pigmented, apices sharply pointed, shaft strongly spiculate; 4, 7-C darkly pigmented, thickened, shaft with a few minute spicules; other hairs simple; relative position, length, and degree of development as figured. Hair 0(1, very large, leaf-like, strongly flattened and expanded, practically transparent), 1(1, practically straight, widened in basal half, sharply pointed), 3(1, well developed and pigmented), 4(1, very long, extending beyond apex of 1-C), 5(1), 6(1), 7(1, 2b), 8(2f), 9(6b), 10(3, 4b), 11(5b), 12(3b), 13(4b), 14(1, long, lightly pigmented, serrated subapically laterad), 15(4, 5b). Antenna about 0.23 of head; shaft of rather uniform width but irregular, with subapical notches for 2, 3-C; width at middle about 0.2 of length; uniformly very darkly pigmented; spicules very strong and dark, sparse and of varying sizes. Antennal hairs, except 1, 5-A, strongly pigmented; relative position, length, and degree of development as figured; all single; 1-A placed at 0.4, its length 2.5 width and 0.4 length of shaft.

Thorax: All hairs and tubercles strongly pigmented; relative position, length, and degree of development as figured; apices of long hairs, except 1, 2-P and 5-M, sharply pointed, not attenuated; barbs when present, slender and lightly pigmented; hair 5-P about 0.77 of head length. Prothorax: hair 0(8, 9b), 1(1, with brush-like frayed apex), 2(1, barbs very long, brush-like at apex), 3(7b, base moderately expanded), 4(2b), 5(1), 6(1), 7(1), 8(6, 9b), 9(5b), 10(1), 11(3b), 12(2, 3f), 14(1). Mesothorax: hair 1(5b), 2(1), 3(4b), 4(4b), 5(1, apex brush-like), 6(1), 7(1), 8(4b), 9(5b), 10(1), 11(2b), 12(1), 13(10, 13d), 14(15, 16d). Metathorax: hair 1(4b), 2(1), 3(6b), 4(4f), 5(1), 6(3, 4f), 7(9b), 8(7, 8b), 9(5b), 10(1), 11(1, 2b), 12(2f), 13(7b).

Abdomen: Tubercles on segments I, II and hairs of all segments strongly pigmented; relative position, length, and degree of development of hairs as figured; barbs when present slender, lightly pigmented and sparse. Stellate hairs (1, 6, 13) weak, with equal branches and sharp points, not attenuated; 4-II a stellate hair. Segment I: hair 1(4b), 2(2b), 3(1), 4(8, 10b), 5(2b), 6(3b, equal branches), 7(1), 8(2f), 9(3, 5b), 10(3f), 12(2, 3f), 13(3, 4f). Segment II: hair 0(1), 1(4, 5b), 2(1), 3(3b), 4(6b), 5(3b), 6(3b, equal branches), 7(1), 8(2f), 9(1), 10(3b), 11(2, 3f), 12(1, 2f), 13(5, 6b). Segment III: hair 0(1), 1(5b), 2(1), 3(3b), 4(3f), 5(2b), 6(7b), 7(3, 4b), 8(2f), 9(1, 2b), 10(2, 3b), 11(2b), 12(1), 13(5, 6b), 14(1). Segment IV: hair 0(1), 1(4, 5b), 2(1), 3(2, 3f), 4(4b), 5(3b), 6(7, 9b), 7(2, 3b), 8(2b), 9(1), 10(2b), 11(1), 12(3b), 13(5, 6b), 14(1). Segment V: hair 0(1), 1(4, 5b), 2(1), 3(5b), 4(2, 3f), 5(2b), 6(7, 8b), 7(2, 3b), 8(1, 2f), 9(1), 10(2, 3f), 11(1), 12(1, 2b), 13(7b), 14(1). Segment VI: hair 0(1), 1(4, 5b), 2(1), 3(4b), 4(3, 4b), 5(2b), 6(6, 7b), 7(2b), 8(2f), 9(1), 10(2b), 11(3b), 12(2f), 13(16, 21d), 14(1). Segment VII: hair 0(1), 1(4b), 2(1), 3(6, 7b), 4(1, 2f), 5(3b), 6(5, 6b), 7(2f), 8(1, 2f), 9(1), 10(2b), 11(3b), 12(1), 13(4b), 14(1). Segment VIII: comb plate heavily sclerotized, lightly pigmented, ornamented with numerous imbricated lines with very distinct spicules caudally; comb scales 10–11, median ones longer, sharply pointed, lateral fringe long but inconspicuous, extending to apical third or more, as figured; hair 0(1), 1(4, 5b), 2(2, 3f), 3(5b, strongly barbed), 4(2f), 5(7, 8b), 14(1). Siphon: as figured; a deep dorsal emargination at base; length 3.6 of median width; uniformly lightly pigmented; imbricate ornamentation without spicules, visible proximally only; pecten extending to 0.5, teeth 13–13 with apical fringe and very inconspicuous short lateral fringe as figured; valves as figured, very heavily sclerotized and very darkly pigmented, ventral valve very long; hair 1(11, 12b, small

asymmetrical expanded base, no barbs visible), 2(1, minute), 3(1, distinct seta), 4, 5(one setal ring visible), 6(1, heavy at base, sharp-pointed, stiff, almost reaching to apex of valve), 7(1, stiff short spine), 8(1, similar to 6, almost reaching to apex of valve), 9(broken off), 10, 11(not observed), 12(1, short stiff spine), 13(1, strong, twisted at base, longer than valve, sharply attenuated); tracheal trunks extremely slender, as figured. Segment X: saddle lightly pigmented, darker dorsally; median width 0.53 of length; imbrications strong dorsally and apically, with faint spicules; caudal margin with a few short, heavy spines and enlarged spicules on apical imbrications; gills slender, about 0.7 of saddle length; hair 1(5, 6b, about 0.2 of saddle length), 2(4b, about 1.6 of saddle length, stiff, heavy, and with nonattenuated, sharp apex), 3(broken off), 4a, b(2b, about 1.1 of saddle length), 4c, d(1, about 1.1 of saddle length), 4e(1, about 0.85 of saddle length).

Types

USNM No. 61,417 (holotype, allotype, paratypes). Paratypes to be deposited in BMNH, CU, and CSIR (Canberra); also in coll. JNB.

HOLOTYPE FLP(624–24) *Guadalcanal:* Togirie Swamp, midway between Bonegi and Poha Rivers, Aug. 23, 1944 (V. R. Roa and F. B. Wysocki). ALLOTYPE MLP (921–301) *Guadalcanal:* swamp west of Poha River, Mar. 20, 1945 (JNB, M. Cohen, E. Winkler).

PARATYPES (69M, 70F, 37P, 320L; 17 individual rearings), all collected on *Guadalcanal*, as follows: 1F, 3L(4-1) Doma Cove, Oct. 21, 1943 (JNB); 3M, 1F, 6L(8) Doma Cove, Oct. 22, 1943 (JNB, R. J. Schlosser, L. J. Lipovsky); 1MLP (83–33), 2L(83–3) Matanikau River valley, Dec. 5, 1943 (JNB); 16L(86–1) tributary of White River, Dec. 6, 1943 (S. Civinski); 1M(149) slough, Bonegi River, Jan. 13, 1944 (JNB); 2M, 2F, 3L(174–3) Tassafaronga, Jan. 25, 1944 (S. Civinski); 1F, 7L(401–2) Mamara River valley, May 25, 1944 (S. Civinski); 1FLP(455–21), 2L(455–2) Sally Creek, Doma Cove, June 14, 1944 (JNB); 1MLP(547–33) Burns Creek valley, Aug. 1, 1944 (L. J. Lipovsky, M. Cohen, S. Civinski); 1M(564) Poha swamp, Aug. 5, 1944 (V. R. Roa, F. B. Wysocki); 1MLP(616–11) Poha swamp, Aug. 19, 1944 (V. R. Roa, F. B. Wysocki); 4MLP(647–11, 12, 13, 17), 2L(647–1) Poha swamp, Sept. 16, 1944 (V. R. Roa, F. B. Wysocki); 1MLP (654–14) Poha swamp, Sept. 23, 1944 (V. R. Roa, F. B. Wysocki); 2FLP (676–31, 32), 1MLP(676–33), 1M, 1F, 5L(676–3) West Poha swamp, Oct. 16, 1944 (JNB, J. Laffoon); 1M, 1F, 5L(708–4) West Poha swamp, Nov. 1, 1944 (JNB); 2FLP(713–11, 12), 1MLP(713–21), 5M, 6F(713–1), 1F(713–3) Poha swamp, Nov. 3, 1944 (L. J. Lipovsky *et al.*); 2M, 2F(714–2), Poha swamp, Nov. 3, 1944 (J. Laffoon); 5M, 4F, 9L, 11P(734–1) East Burns Creek, Nov. 15, 1944 (C. Calloway); 3M, 2F, 5L(775–3) Matanikau Village, Dec. 9, 1944 (JNB, J. J. Cuccio, F. B. Wysocki); 1M, 2F, 4L(796–3) White River valley, Dec. 27, 1944 (F. B. Wysocki, Shaw); 3M, 3F, 26L, 2P(802–3) West Poha swamp, Jan. 5, 1945 (M. Cohen, C. Calloway, Shaw); 2M, 1F(842–2) Tyler Creek, Jan. 24, 1945 (Hawkins); 6M, 6F, 116L(816–3) West Poha swamp, Jan. 12, 1945 (M. Cohen, F. B. Wysocki); 11L(837–3) West Poha swamp, Jan. 20, 1945 (J. J. Cuccio, F. B. Wysocki); 1F(846–2) Kukum, Jan. 30, 1945 (M. Cohen, F. B. Wysocki, J. J. Cuccio); 3F, 59L, 5P(848–2), 4M, 10F(848) Lankford swamp, Kukum, Feb. 1, 1945 (J. J. Cuccio, C. Calloway, Williams); 2FLP(850–31, 35), 4M, 2F(850–3), 2M, 1F(850) Lankford swamp, Kukum, Feb. 2, 1945 (M. Cohen, J. J. Cuccio, F. B. Wysocki); 2F(921–3) same data as allotype; 2M, 1F, 11L(958–2) Poha valley, Apr. 28, 1945 (J. J. Cuccio, E. J. McCormick and V. R. Roa); 4M, 4F(970–3) West Poha swamp, May 6, 1945 (JNB); 1F(1140) routine night catch, Poha area, Apr. 5, 1944 (S. Civinski); 1F(Sta. 5) routine night catch, mouth Matanikau River, Mar. 14, 1944; 2M(1283) flying and resting, West Poha swamp, Nov. 3, 1944 (L. J. Lipovsky); 1F,

2L, Tenaru, Oct. 18, 1943 (J. G. Franclemont); 1M(0–24) Tenaru, Sept. 10, 1943 (P. W. Oman); 1F, 7L(0–32) Tenaru, Sept. 9, 1943 (P. W. Oman); 2M, 1F(K-910) June 21, 1943 (K. L. Knight); 2M(G-40) Dec. 5, 1943 (A. B. Gurney).

Uranotaenia barnesi is named in honor of Arthur W. Barnes, Jr., to whom I am greatly indebted for the painstaking rearing of much of the material collected on Guadalcanal.

Variation

The adults of *U. barnesi* show a great deal of variation in the amount of orbital light scaling on the head. Usually the light-scaling is extensive and very conspicuous. The thoracic light-scaling shows less variation. The modified foreleg of the male is extremely variable in the degree of development of the specialized scales and hairs, but they conform to the arrangement as illustrated. It is probable that some of the differences noted are due to the teneral condition of reared specimens. One female has the apical two segments of the left fore tarsus white-scaled.

The variation in the chaetotaxy of the immature stages is summarized in Tables 1 and 2. There is a rather narrow range of variation in the branching of the hairs despite the fact that many collections were made at all seasons of the year. No unusual variations were observed.

The material from other islands falls within the range of variation exhibited by specimens from Guadalcanal.

Specimens examined: 90M; 92F; 51P; 402L. Individual rearings: 19 larval.

Taxonomic Discussion

Uranotaenia barnesi is closely related to three New Guinea species of the *tibialis*-group described by King and Hoogstraal (1947: 585–596): *U. setosa*, *U. neotibialis*, and *U. fimbriata*. It is unfortunate that the two earliest nominal species in this group, *U. tibialis* Taylor, 1919, and *U. antennalis* Taylor, 1919, are not definitely recognizable at present. Since they were both proposed for specimens from Cairns, Queensland, it is unlikely that they would represent species from the Solomon Islands, particularly when it appears from the work of King and Hoogstraal that the *tibialis*-group is composed of a number of closely related species in New Guinea, none of which can be definitely associated with Taylor's species, and all of which are distinct from *U. barnesi*.

King and Hoogstraal (1947: 593) examined specimens of *U. barnesi* and noted their similarity to *U. fimbriata* K. and H., 1947. The two species are very closely related but are distinct in the following characters of the male of *U. barnesi:* light-scaling of head very wide instead of narrow; wing with conspicuous light scales at base of R, Cu, and 1A; fore tibia longer, 0.9 instead of 0.7 length of femur; fore tarsus 3 longer, 1.1 instead of 1.0; hind tarsus white from extreme apex of segment 2 instead of basal third of segment 3; white-scaling of hind tarsus 2 produced ventrally from apex, demarcation rather indistinct; light-scaling of head, scutum, pleura, and wing a rather intense azure-blue instead of white. The female of *U. fimbriata* is unknown but it appears likely that it would be separable from that of *U. barnesi* by the extent of the light-scaling of the hind tarsus, since this character does not show marked sexual differences in this genus. The same character will separate *U. barnesi* females from those of *U. setosa*, which has the hind tarsus white from the apex of the third segment only. The female of *U. tibioclada* is unknown, but again since the male does not show any white-scaling on the apex of the second segment it is likely that the female will differ from *U. barnesi* in this character also.

The pupal stage of *U. fimbriata* is not known, and only the trumpets have been described and figured for *U. setosa* and *U. tibioclada*. The trumpets of *U. barnesi* agree in coloration with these two species but appear to be intermediate in length. The pupa described and figured by Penn (1949: 32–33) as *U. albescens* is undoubtedly that of a mem-

ber of the *tibialis*-group. It differs from *U. barnesi* in a number of characters.

The larva of *U. barnesi* is generally similar to those of *U. setosa* and *U. tibioclada*, that of *U. fimbriata* being unknown. It differs from both in having: a much longer siphon, index about 3.5 against 2.0 or less; siphonal hair 1-S 10, 11b(10–13) instead of 8b; hair 5-VIII 8, 7b(6–8) against 4, 5b.

Outside of the Australasian region, three Philippine species, *U. ludlowae* Dyar and Shannon, 1925, *U. clarae* Dyar and Shannon, 1925 (= *U. delae* Baisas, 1935, NEW SYNONYMY) and *U. reyi* Baisas, 1935, appear to me to be definitely related to *U. setosa*, *U. fimbriata*, *U. neotibialis*, and *U. barnesi* on the basis of modifications of the foreleg of the male (where known), light-scaling of the head, thorax, and hind tarsus, and in the larva on the basis of the development of hair 4-C and leaf-like antennal hairs 2, 3, 4-A. As noted by King and Hoogstraal (1947: 592) *U. clarae* (as *U. delae*r and *U. reyi* were described from males rather than females. *U. clarae* appears to be close) to *U. barnesi* than even *U. fimbriata* in having the hind tarsus white from the apex of segment 2 in the adult, and in the definitely subapical position of antennal hair 2, but differs in lacking specialized hairs at the base of segment 1 of the fore tarsus of the male.

It is surprising, in view of the occurrence of this species complex in the Papuan and Philippine subregions, that to date no related species have been described from intermediate areas in Borneo or Indonesia. The nearest approach to this group found in Assam, Burma, and Hongkong is *U. annandalei* Barraud, 1926, a species also reported from the Philippines (Baisas, 1935: 64) and presumably present in intermediate areas. *Uranotaenia annandalei* resembles *U. barnesi* in having a modified larval antenna with leaf-like hairs but differs in the development of hair 4-C in the larva and the absence of modifications of the foreleg of the male as well as the coloration of the thorax and hind tarsus of the adult.

The only other Australasian species (also occurring in the Oriental region) with modified foreleg in the male is *U. atra* Theobald, 1905. In this form the modifications are restricted to the tarsus, do not involve the apex of the tibia, and the hind tarsus is dark. A somewhat similar but less conspicuous modification occurs in the Ethiopian *U. pallidocephala* Theobald, 1908, a species very distinct in its thoracic ornamentation as well as in the modifications of the hind tarsus of the male.

Biology

U. barnesi breeds largely in dense freshwater jungle swamps having a high organic content in the water. It prefers shade but will utilize open situations on occasions. On Guadalcanal it was frequently collected in small pools, foxholes, and road ruts, and less frequently in rock pools and side pools of small, densely shaded streams.

The species most frequently associated with it on Guadalcanal were *Bironella hollandi* Taylor, 1934, *Hodgesia cairnsensis* Taylor, 1919, various species of the subgenera *Culex* and *Lophoceraomyia*, *Uranotaenia sexaueri* n. sp., *U. civinskii* n. sp., *U. solomonis* n. sp., and *Anopheles lungae* Belkin and Schlosser, 1944, *Anopheles solomonis* Belkin, Knight and Rozeboom, 1945, and *Anopheles nataliae* Belkin, 1946.

Living larvae of *U. barnesi* are easily recognized from other species of *Uranotaenia* by the wide thorax and the narrow, lobed abdomen which give it a characteristic slender appearance. The abdomen and thorax are usually a dark translucent brown. The shortness of the siphon, the characteristic horizontal subsurface resting position, and the definitely elongate head make this species of *Uranotaenia* superficially very similar to the younger larval stages of anophelines, particularly *Bironella*. The pupal stage is easily separated in the field from all other *Uranotaenia* except *U. atra* by the extremely slender trumpets and from the latter by the light pigmentation of the middle of the trumpets as well as the strongly contrasting light (dorsal)

and dark (ventral) pigmentation of the cephalothorax. The small size and the length of trumpets will normally separate this species from all other mosquitoes in the field.

The adults of *U. barnesi* have been collected in nature resting on tree buttresses in the jungle as well as flying in shaded situations. Both males and females have been collected occasionally in hand night catches but never actually biting. They are moderately attracted to lights at night.

Distribution

SOLOMON ISLANDS, *Guadalcanal:* Generally distributed throughout the year on north-central and northwest coast (JNB *et al.*, J. G. Franclemont *et al.*, P. W. Oman, K. L. Knight, A. B. Gurney, H. E. Milliron *et al.*) [USNM, CU, JNB]. *Florida:* Halavo, 6L(K-841) Dec. 17, 1943 (K. L. Knight) [USNM]. *Russell:* Banika, 1M, Apr., 1943 (W. G. Downs); Pavuvu, 3L, Mar., 1943 (W. G. Downs); 1F, 1944 (R. B. Eads) [USNM]. *New Georgia:* Munda, 1M, 1F, 7L, 1P, Jan. 10, 1944 (J. G. Franclemont) [USNM, JNB]. *Bougainville:* Empress Augusta Bay, 16M, 14F, Mar. 1, 1943 (C. R. Bruck); 3L(G-323) Apr. 18, 1944; 5L(G-432) Jul. 8, 1944; 1M, 2F(G-423) (A. B. Gurney) [USNM, JNB].

3. ***Uranotaenia civinskii*** Belkin n. sp.
Plates 5, 6

1929. *Uranotaenia argyrotarsis* Leicester var. Edwards *in* Paine and Edwards, Bul. Ent. Res. 20: 312–313.

1944. *Uranotaenia argyrotarsis* Leicester. Knight, Bohart, and Bohart, Keys Mosq. Australasian Reg. p. 15, 68 (*partim*).

Diagnosis

ADULT.—Head dark centrally; wide bluish-white orbital line, conspicuously expanded laterally; four pairs of erect dark vertical scales; conspicuous frontal tuft of light scales. Narrow supra-alar line of bluish-white scales angled dorsad anteriorly; *apn* and *stp* each with narrow line of bluish-white semierect scales forming streak in line with white-scaling of head. Hind tarsus white-scaled from apical fifth of segment 2; apical segments of I, II Tar cream-colored; small subapical light patch on III Tib of female. Wing with bluish-white scales on base of R, Cu, and 1A. Abdominal tergites 2–4 conspicuously white in female; in male tergite 4 largely white, small white patches on 2 and 3. *Male* hind tibia bent at base and with two long curved, one short straight bristle.

PUPA.—Trumpet length about 5.0 median width; tracheoid extending to about 0.50; uniformly darkly pigmented; slit in meatus. Hair 1-II secondarily branched; 4-V–VII usually 3b, longer than following tergite.

LARVA.—Head distinctly longer than wide; hairs 5, 6-C strong spikes; 4-C moderate, 3b(2–4); 7-C 4, 5b(4–6); 9-C long, 2, 3b. Antennal hairs simple; 1-A moderate, at basal third. Thorax and abdomen with strong stellate hairs, branches even. Thoracic hairs 9-P long 2b(2–3), 10-P single, barbed; 9-M, T, 8-M, 7-T long, multiple, barbed; 4-P 3b; 7-P 2b; 14-P moderate, 6, 5b(4–8); apices of long hairs attenuated. Abdominal hairs 6-III–VIII stellate, much shorter than 6-I, II, without tubercles; 7-I, II 5–8b; 6-I, II 2b, branches uneven; 6-III, IV 6, 7b(5–9). Comb plates separate; scales fringed, not markedly enlarged in middle. Siphon index about 5.0; pecten extending to about 0.5; pecten teeth with apical and lateral fringe, 16, 15(13–18); hair 1-S moderate 10, 9b(8–13); valves moderate; hair 9-S moderate, hook-like; 13-S strong, twisted at base. Anal segment moderate; saddle margin with sparse short apical spines; gills about 0.6 saddle length; hair 1-X 5, 4b(4–7), moderate; 2-X 3b; 3-X 2b; 4a-X 3b; 4b-X 2b.

Description

FEMALE (504–44).—Wing: 2.30 mm. Abdomen: 1.40 mm. Proboscis: 1.50 mm. Front femur: 1.83 mm.

Head: Vertex with a conspicuous frontal tuft

of elongate bluish-white scales merging into broad scales; broad orbital line of broad bluish-white scales, expanding gradually into a broad patch toward *apn;* four pairs of dark, elongate, apically forked erect scales bordering the light scales mesally; large triangular area of dark broad decumbent scales dorsocentrally; two pairs of shorter slender forked dark occipital erect scales; inner occipital not seen, outer three at level of lateral expansion of light orbital line. Clypeus brown. Palpus about 0.05 of proboscis; with minute dark scales and numerous long dark hairs. Proboscis distinctly swollen apically; dark-scaled, appearing lighter ventrally; short lateral hairs becoming longer apically on swollen portion; labella light brown, moderately hairy. Antenna about 1.2 of proboscis; torus light brown, apparently without hairs, appearing flattened and laterally expanded; flagellum darker, about six bristles in whorls; hairs and scales scanty basally, becoming more numerous apically; apical segments gradually lengthened, apical only slightly longer than penultimate.

Thorax: Scutal integument dark brown with indistinct lighter longitudinal stripes; moderately dense vestiture of recumbent, narrow, elongate, golden-brown scales, becoming broader and darker in prescutellar space; supra-alar line of bluish-white scales as figured, anterior scales small, moderately elongate, becoming very slender caudally; acrostichals moderate, other bristles strong, all dark, supra-alars few in number. Scutellum brown; median lobe moderate with three bristles weaker than those of lateral lobes, scaled area extensive, scales short, rounded apically, projecting only slightly over base of bristles; lateral lobe with two very strong and two weak bristles, scales elongate, projecting moderately over base of bristles. Postnotum dark brown, lighter laterally. Pleural integument brown, light iridescent areas in line with light-scaling; scaling and chaetotaxy as figured; scales iridescent bluish-white, patches on *apn* and middle sternopleuron in line with light-scaling of head; scales of *apn* small and elongate anteriorly, becoming more slender and longer to form a projecting tuft caudally; those of middle sternopleuron arranged in about two rows, individual scales moderately elongate, larger than on *apn*, scales semierect; scales on lower sternopleuron practically transparent, in several irregular small patches; bristles dark, propleurals very short, light colored. Haltere light on base, darker on stem distally, knob dark-scaled.

Wing: Distance between crossveins about equal to *m-cu*. Vein R_2 about 0.4 of R_{2+3}; vein M_{1+2} about 0.7 of M beyond *m-cu*. Iridescent bluish-white scales dorsally on caudal margin of R to slightly beyond arculus and on anterior margin also at extreme base of R; larger, almost circular similar scales on basal 0.5 of Cu; a few white scales on base of 1A; two or three white scales at extreme base of C; remaining dorsal scales dark, slightly darker on anterior margin, iridescent bronzy; fringe light, darker on apex.

Legs: Coxae light brown, with translucent scales and light hairs and bristles; trochanters light brown, with a few translucent scales and light hairs; femora dark-scaled above, lighter below; fore and mid tibiae entirely dark-scaled; hind tibia with small subapical patch of light scales on external face; first segment of front and middle tarsi dark, apical four segments cream-colored; hind tarsus white-scaled on 0.8 from base of segment 2 and entire segments 3–5, remainder dark. Leg I: femur 1; tibia about 1.0, with small apical tuft of specialized scales; tarsus 0.90, 0.40, 0.30, 0.14, 0.08. Leg II: femur 1.11, moderately swollen basally; tibia 1.60; tarsus 0.93, 0.41, 0.30, 0.10, 0.09. Leg III: femur 1.20; tibia 1.22; tarsus 1.10, 0.64, 0.55, 0.22, 0.10.

Abdomen: Tergites 2, 3, and 4 each with a broad median trapezoidal patch of pure white scales, patches broader apically; other tergites dark-scaled; sternites dull white-scaled.

MALE (504–45).—Wing: 1.25 mm. Proboscis: 1.40 mm. Front femur: 1.45 mm.

Generally very similar to female. Vertex of head more extensively dark-scaled. Proboscis

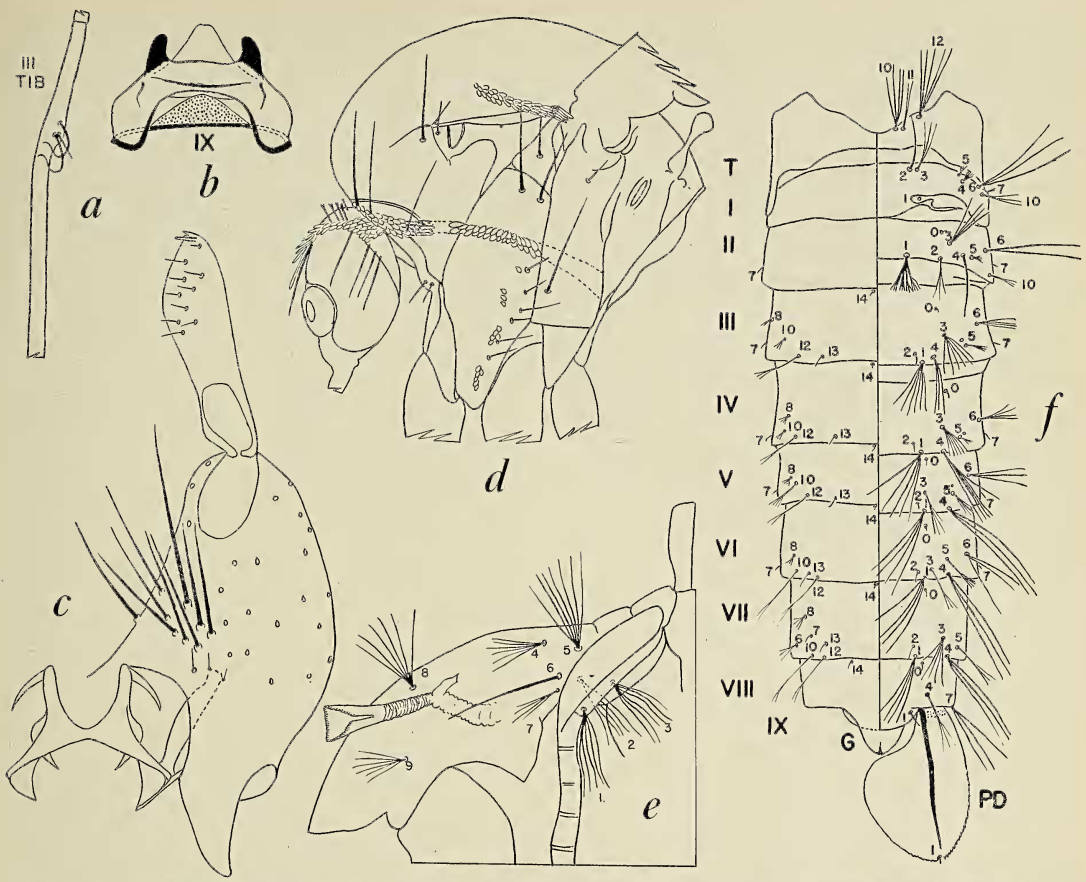

FIG. 5. *Uranotaenia civinskii* Belkin n. sp. *a–d*, Adult; *e*, *f*, pupa. *a*, Detail of metathoracic leg of male; *b*, ninth tergite of male; *c*, male genitalia; *d*, left lateral aspect of head and thorax of female; *e*, right lateral aspect of anterior portion of cephalothorax of pupa; *f*, metanotum and abdomen of male pupa, left ventral, right dorsal. Abbreviations as given on page 314.

very strongly swollen apically. Flagellar whorls about 0.29 of flagellum, about 24 hairs in whorl; basal flagellar segments short, basal part strongly swollen; penultimate segment slightly less than 2.0 of preceding, apical about 1.7 of penultimate. Leg I: femur 1; tibia 1.0; tarsus 0.90, 0.33, 0.33, 0.11, 0.06; claws equal, one broadened, other slender. Leg II: femur 1.10; tibia 1.40; tarsus 0.90, 0.33, 0.20, 0.06, 0.08, segment 4 with ventral lobe projecting below 5; claws unequal, enlarged, smaller 0.6 of larger, both strongly curved. Leg III: femur 1.16; tibia 1.10, as figured, straight in basal 0.25, then curved, basad of curve one short straight and two long curled bristle; tarsus 1.0, 0.50, 0.44, 0.20, 0.08; claws equal as on foreleg. Abdomen: tergite 4 with large patch of dull white scales, broad apically, narrowed triangularly almost to base; tergites 3 and 2 with smaller median apical light patches.

MALE GENITALIA (504–45).—As figured. Ninth tergite long, without bristles; proximal part very strongly and deeply emarginate; strong secondary subbasal transverse sclerotization; apex widely and deeply emarginate leaving a strongly projecting, heavily sclerotized tooth-like lobe on each side. Proctiger with a pair of long, weak, ventrolateral sclerotizations. Basal lobe of sidepiece with a dorsal group of eight bristles arranged in three irregular rows and two ventral bristles. Clasper

as figured. Mesosome with an incompletely sclerotized ventral bridge in addition to dorsal bridge; an apical and a median spine on each plate, apical spine projecting laterad, median mesad, spines subequal. Paramere with a weakly sclerotized median expansion (not shown in figure).

PUPA (Exuviae of holotype, 504–44).— Abdomen: 1.83 mm. Trumpet: 0.32 mm. Paddle: 0.50 mm.

Cephalothorax: Uniformly moderately pigmented, slightly darker on leg cases and metanotum. Trumpet uniformly darkly pigmented; length 5.30 of median width; gradually widened to apex; inner wall indistinct; tracheoid extending about 0.5 on lateral surface, very poorly developed on mesal surface except at extreme base; reticulate with imbrications ending each in one sharp spicule, more distinct on mesal surface and extending basad through the tracheoid portion; pinna about 0.23; distinct mesal slit in meatus extending about 0.18 of trumpet length. Hairs moderately pigmented and simple; relative position, length, and degree of development as figured; larger branched hairs with slender base slightly expanded apically where branches arise. Hairs: 1(5b), 2(5, 6b), 3(5b), 4(4, 6b), 5(6, 7b), 6(1), 7(4f, base simple), 8(7b), 9(6b, base simple), 10(4b), 11(2b), 12(5, 6b). *Abdomen:* Moderately pigmented, somewhat darker basally, ventral intersegmental sclerotizations darker; tergites III–VII each with a posteromedian patch of distinct small spicules; tergite II with larger patch extending cephalad; tergite VIII with smaller median patch; tergal integumentary reticulations indistinct; sternites III–VII each with extensive median patch of small spicules; sternite II with narrow caudal transverse band of spicules arising from faint arcuate imbrications; sternite VIII with smaller anteromedian patch of spicules. All hairs moderately pigmented; relative position, length, and degree of development as figured; larger branched hairs with inconspicuous short basal part only slightly enlarged apically where branches arise. Segment I: hair 1(14, 16 primary branches, dense brush-like secondary branching at about 0.4–0.6 from base; about 0.75–0.80 length of tergite), 2(1), 3(3b), 4(5, 6b), 5(3, 4b), 6(2b), 7(2, 3b), 10(2, 3b). Segment II: hair 0(1), 1(3 primary branches, each with 3–5 secondary apical branches), 2(3, 4b), 3(4b), 4(1), 5(3f), 6(3b), 7(1), 10(2b). Segment III: hair 0(1), 1(7, 8b), 2(1), 3(5, 6b), 4(3b), 5(2, 3f), 6(4b), 7(1), 8(2f), 10(3, 4f), 12(3b), 13(1), 14(1). Segment IV: hair 0(1), 1(6b), 2(1), 3(5b), 4(4, 5b), 5(2f), 6(3, 4b), 7(1), 8(2, 3b), 10(2f), 12(3b), 13(1), 14(1). Segment V: hair 0(1), 1(4b), 2(1), 3(3f), 4(3b), 5(3b), 6(3, 4b), 7(1), 8(3, 4b), 10(4b), 12(2f), 13(1), 14(1). Segment VI: hair 0(1), 1(4b), 2(1), 3(2f), 4(2, 3b), 5(2, 4f), 6(3b), 7(1), 8(2, 3b), 10(2f), 12(1, 2f), 13(1), 14(1). Segment VII: hair 0(1), 1(3b), 2(1), 3(4b), 4(3b), 5(1, 2f), 6(3b), 7(1), 8(2, 3b), 10(2f), 12(2, 3f), 13(1), 14(1). Segment VIII: caudal margin of sternite shallowly emarginate; hair 0(1), 4(1, 3f), 7(2b), 14(1). Segment IX: hair 1(1, about 0.9 of segment length). Paddle as figured; lightly pigmented; midrib strongly sclerotized, evanescent apically; external buttress distinct proximally; basal pigment bar distinct; external margin with serrations from buttress caudad, becoming strongly sclerotized on apical half; internal margin with larger, poorly sclerotized, sparse crenulations; hair 1 minute, represented largely by socket. Genital lobe extending to 0.21 of paddle; with small ventrocaudal apical patch of spicules. Anal segment indistinct, cercal sclerites not defined. Male genital lobe (exuviae of allotype, 504–45) extending to 0.24 of paddle; pair of large ventral lateral basal patches of strong spicules; anal segment indistinct, extending slightly beyond apex of IX.

LARVA (Fourth instar exuviae of holotype, 504–44).—Head: 0.70 mm. Siphon: 0.70 mm. Anal saddle: 0.34 mm.

Head: Width 0.7 of length; ocular bulge prominent; ocular areas lightly pigmented, between and cephalad of these moderately pigmented, caudad very darkly pigmented;

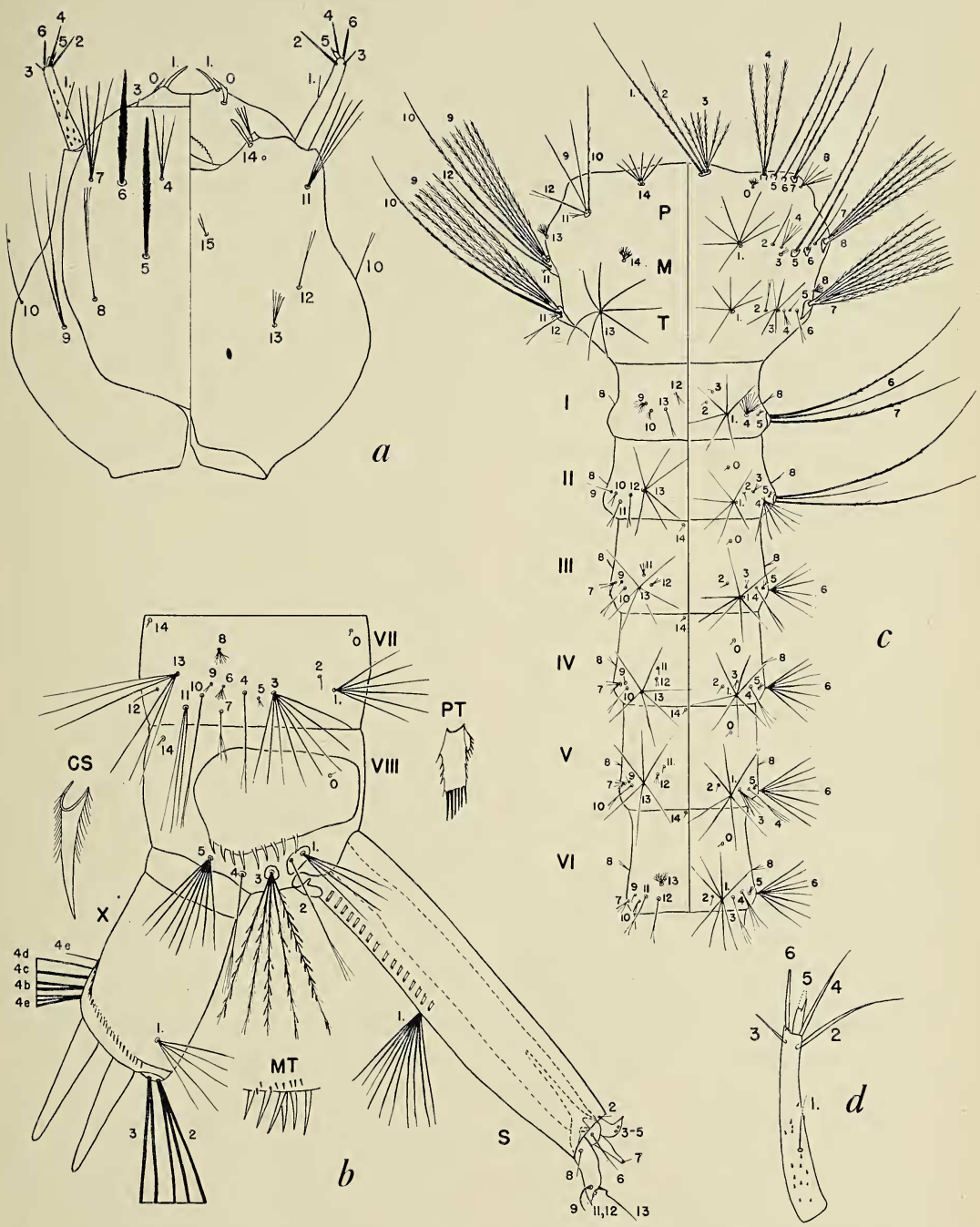

FIG. 6. *Uranotaenia civinskii* Belkin n. sp. Fourth instar larva. *a*, Head, left dorsal, right ventral; *b*, left lateral aspect of distal abdominal segments; *c*, thorax and proximal abdominal segments, left ventral, right dorsal; *d*, dorsal aspect of left antenna. Abbreviations as given on page 314.

integumentary imbricate sculpturing very prominent and uniform. Labrum moderately long, 0.3 of width at 1-C, anterior margin very deeply emarginate (twice as deep as figured). Mental plate (more triangular than figured) with 21 blunt teeth, faintly indicated. Hairs of head capsule well pigmented, conspicuous; 5, 6-C spike-like, very darkly pigmented, apices sharply pointed, shaft very minutely spiculate, more conspicuously apically; 7, 11-C very minutely barbed, other hairs simple; relative position, length, and degree of development as figured. Hair 0(1, very well developed, reaching to middle of 1-C, very lightly pigmented, flattened and broadened basally, with external tooth), 1(1, very slightly curved, short, sharply pointed), 3(1, minute, stiff and heavily pigmented), 4(3b), 5(1), 6(1), 7(4b, short expanded base), 8(1, 2f), 9(2b), 10(2f), 11(5b, slightly expanded short base), 12(2f), 13(5, 6b), 14(broken off), 15(2f). Antenna 0.23 of head; shaft distinctly narrowed at 0.6; width at middle about 0.17 of length; uniformly very darkly pigmented; spicules small, sparse. Antennal hairs well pigmented, except apex of 5-A; relative position, length, and degree of development as figured; all single; 1-A placed at about 0.32, length about 1.4 of antennal width.

Thorax: All hairs and tubercles strongly pigmented; relative position, length, and degree of development as figured; apices of long hairs attenuated and sharply pointed; barbs when present numerous, long and slender and moderately conspicuous; hair 5-P about as long as head. Prothorax: hair 0(12, 14d), 1(1), 2(1), 3(8, 9b, large expanded base), 4(3b), 5(1), 6(1), 7(2b), 8(5b), 9(2b), 10(1), 11(3f), 12(2f), 14(6b, expanded asymmetrical base). Mesothorax: hair 1(6b), 2(1), 3(3, 5b), 4(4, 5b), 5(1), 6(1), 7(1), 8(6b), 9(5b), 10(1), 11(1), 12(1), 13(21, 23d), 14(29, 30d). Metathorax: hair 1(4, 5b), 2(2, 3f), 3(6b), 4(4b), 5(1), 6(2f), 7(8b), 8(11b), 9(5b), 10(1), 11(2, 4b), 12(2f), 13(8b).

Abdomen: Tubercles of segments I, II and hairs of all segments well pigmented; relative position, length, and degree of development as figured; barbs when present slender, lightly pigmented and sparse. Stellate hairs (1, 6, 13) with equal branches; 4-II a stellate hair. Segment I: hair 1(6, 7b), 2(1, 2b), 3(1, 2b), 4(11, 15b), 5(4, 5b), 6(2b), 7(1), 8(2f), 9(9, 11b), 10(3, 5b), 12(1, 3b), 13(1, 2f). Segment II: hair 0(1), 1(4, 5b), 2(1), 3(5b), 4(6b), 5(2, 3b), 6(2b), 7(1), 8(1), 9(1), 10(2b), 11(2, 3f), 12(1, 2f), 13(4, 5b). Segment III: hair 0(1), 1(5, 6b), 2(1), 3(2b), 4(2f), 5(2, 3b), 6(6b), 7(5b), 8(2b), 9(1), 10(2f), 11(3b), 12(2, 3b), 13(5, 7b), 14(1). Segment IV: hair 0(1), 1(6, 7b), 2(1), 3(1, 2f), 4(4, 3f), 5(3, 4b), 6(6, 7b), 7(4, 5b), 8(2, 3f), 9(1), 10(2, 3f), 11(1), 12(1, 2b), 13(6b), 14(1). Segment V: hair 0(1), 1(6b), 2(1), 3(5b), 4(2f), 5(4b), 6(6b), 7(5b), 8(3b), 9(1), 10(2, 3f), 11(1), 12(2, 3b), 13(6, 7b), 14(1). Segment VI: hair 0(1), 1(6b), 2(1), 3(2, 4f), 4(2b), 5(3b), 6(6b), 7(3b), 8(2, 3b), 9(1), 10(1, 2b), 11(2f), 12(2f), 13(25, 32d), 14(1). Segment VII: hair 0(1), 1(5b), 2(1), 3(8b), 4(2f), 5(3, 4b), 6(6, 7b), 7(4, 5f), 8(7, 9b), 9(2b), 10(2f), 11(2, 3b), 12(1), 13(5, 6b), 14(1). Segment VIII: comb plate heavily sclerotized, moderately pigmented, ornamented with numerous imbrications with very distinct spicules caudally; comb scales 8–9, median ones longer, very sharply pointed, with conspicuous lateral fringe in basal half as figured; hair 0(1), 1(3, 5b), 2(2f), 3(6b, barbed), 4(2f), 5(8, 9b), 14(1). Siphon: as figured; median width 5.0 of length; uniformly moderately pigmented, ornamented basally with faint, spiculeless imbrications; pecten extending to almost 0.5, teeth 16–16 with lateral and apical fringe as figured; valves as figured, darker than siphon, ventral valve moderate; hair 1(10b, basal expansion very short, inconspicuous; barbs extremely small and sparse), 2(1, moderate, slender), 3–5(only 2 setal rings visible), 6(1, well developed), 7(1, slender, conspicuous), 8(1, slender, about 0.5 of valve), 9(1, moderately strong, hook-like), 10–12 (not observed), 13(1, strong, twisted at base, about length of valve). Seg-

ment X: saddle moderately pigmented, darker dorsad; median width 0.73 of length; imbrications weaker than on comb plate except caudally; caudal margin with sparse spines of varying length, proximal ones arising from imbrications; gills slender, about 0.6 of saddle length; hair 1(5b, about 0.5 of saddle length), 2(3b, about 3.0 of saddle length), 3(broken off), 4a–d (broken off), 4e(1, about 0.2 of saddle length).

Types

USNM No. 61,418 (holotype, allotype, paratypes). Paratypes to be deposited in BMNH, CU, and CSIR (Canberra); also in collection JNB.

HOLOTYPE FLP (504–44) and ALLOTYPE MLP (504–45) *Guadalcanal:* Bonegi River valley, 2 miles from coast, July 18, 1944 (L. J. Lipovsky, S. Civinski, H. F. Sexauer).

PARATYPES (57M; 56F; 61P; 146L; 9 individual rearings), all collected on *Guadalcanal*, as follows: 11L (14–3) Doma Cove, Still River area, Oct. 25, 1943 (JNB *et al.*); 1FLP(64–31), 1M(64–3) Wrights Creek, Nov. 27, 1943 (JNB *et al.*); 2MLP(83–21, 22), 5M, 7L(83–3) Matanikau River valley, Dec. 5, 1943 (JNB); 1F(86) White River, Dec. 6, 1943 (S. Civinski); 2L(96–2) La Sage Creek, Pt. Cruz, Dec. 13, 1943 (S. Civinski); 1M, 1F(296–3) Chacon swamp, Mar. 4, 1944 (L. J. Lipovski, F. B. Wysocki); 2FLP(397–21, 22), 2L(397–2) Kiwi Creek, Kukum, May 23, 1943 (V. R. Roa, F. B. Wysocki); 1F(411–3) Burns Creek, Lunga, May 27, 1943 (V. R. Roa, F. B. Wysocki); 6L(455) Sally Creek, Doma Cove, June 14, 1944 (JNB); 1M, 2F, 1L, 1P(472–1) Poha River valley, Jul. 6, 1944 (JNB *et al.*); 1F(490–3) between Poha and Bonegi rivers, Jul. 14, 1944 (M. Cohen, F. B. Wysocki); 1LP(558–21) Matanikau Village, Aug. 4, 1944 (J. J. Cuccio, E. J. McCormick); 1MLP (561–15), 1FLP(561–14), 4M, 6P, 3L, 3P (561–1) Matanikau River valley, south of village, Aug. 4, 1944 (L. J. Lipovsky); 4L (574–3) Matanikau River valley, 2 miles south of village, Aug. 6, 1944 (JNB, M. Cohen); 1LP(577–31) Matanikau River valley, 3 miles south of village, Aug. 6, 1944 (JNB, M. Cohen); 1LP(581–21) Matanikau River valley, 1 mile south of village, Aug. 6, 1944 (JNB, M. Cohen); 1FLP(592–21) Kokumbona, Aug. 11, 1944 (J. J. Cuccio, E. J. McCormick); 2F, 2L(621–2) Matanikau River valley, 1 mile south of village, Aug. 22, 1944 (JNB); 1M, 1F(654) West Poha swamp, Sept. 23, 1944 (V. R. Roa, F. B. Wysocki); 2M, 1F(661–2) Poha River, Sept. 23, 1944 (M. Cohen, J. J. Cuccio, E. J. McCormick); 1L(676) West Poha swamp, Oct. 16, 1944 (JNB, J. Laffoon); 1M(713–1) West Poha swamp, Sept. 23, 1944 (V. R. Roa, F. B. Wysocki); 2M, 1F(661–2) Poha River, Sept. 23, 1944 (M. Cohen, J. J. Cuccio, E. J. McCormick); 1L(676) West Poha swamp, Oct. 16, 1944 (JNB, J. Laffoon); 1M(713–1) West Poha swamp, Nov. 3, 1944 (L. J. Lipovsky *et al.*); 7M, 7F, 15L, 22P(764–3) Matanikau River valley, 1 to 3 miles south of village, Dec. 2, 1944 (JNB *et al.*); 1F(770–2) Matanikau River valley, Dec. 8, 1944 (J. J. Cuccio, E. J. McCormick, F. B. Wysocki); 3F(771–2) Poha River, near mouth, Dec. 8, 1944 (M. Cohen); 2M, 2F, 9L, 5P(775–3) Matanikau River valley, 1 mile south of village, Dec. 9, 1944 (JNB *et al.*); 1F(776–2) same data as 775–3 but in tree hole (JNB *et al.*); 2M, 5L, 3P(782–4) Tyler Creek, Matanikau valley, Dec. 21, 1944 (F. B. Wysocki, Shaw); 1M, 2F, 6L, 8P(787–3) Wrights Creek, Matanikau valley, Dec. 20, 1944 (M. Cohen, F. B. Wysocki); 1F, 2L(796–3) White River, Dec. 27, 1944 (F. B. Wysocki, Shaw); 8L, 7P(827–2) Matanikau River valley, 1 mile south of village, Jan. 18, 1945 (M. Cohen, F. B. Wysocki *et al.*); 1F, 10L(828–2) Manatikau Village (M. Cohen, F. B. Wysocki *et al.*); 1M, 2F, 6L(829–2) same as 828–2; 1MLP(850–23), 1F(850–2), 1M(850–3), 1M(850) Lankford swamp, Feb. 2, 1945 (Hawkins, Dimard); 6M, 4F(863–4) first tributary south of Poha Village, Feb. 12, 1945 (JNB *et al.*); 1M, 1F, 10L(864–3) stream between Poha Villages, Feb. 12, 1945 (JNB *et al.*); 1M(921) West

Poha swamp, Mar. 20, 1945 (JNB, M. Cohen, E. Winkler); 1F(930–3) Sprague swamp, Doma Cove, Mar. 26, 1945 (JNB, M. Cohen); 2M, 2F(933) Poha River, first tributary north of village, Apr. 1, 1945 (JNB); 1L(958–2) West Poha swamp, Apr. 28, 1945 (J. J. Cuccio, E. J. McCormick, V. R. Roa); 1M(970–3) West Poha swamp, May 6, 1945 (JNB); 3M(1221) Sprague swamp, Doma Cove, resting on tree buttresses, June 7, 1944 (JNB); 1F(1283) West Poha swamp, flying, Nov. 3, 1944 (L. J. Lipovsky); 2M, 1F(1405) Tassafaronga, flying, May 7, 1945 (M. Cohen, E. Winkler); 3L, Tenaru, Oct. 18, 1943 (J. G. Franclemont); 1F(K-888), Dec. 24, 1943 (K. L. Knight); 5M, 4F, 8L(K-892) Dec. 26, 1943 (K. L. Knight); 2L(K-897) Dec. 27, 1943 (K. L. Knight); 1M, 1L(K-949) Aug. 24, 1943 (K. L. Knight); 5L(0–13) Aug. 19, 1943 (P. W. Oman); 1F(0–37) June 16, 1944 (P. W. Oman); 1M(0–251) Sept. 4, 1944 (P. W. Oman); 1L(G-37) Dec. 3, 1943 (A. B. Gurney); 4L(G-74) Nov. 26, 1943 (A. B. Gurney); 4L(G-90) Dec. 5, 1943 (A. B. Gurney); 1L(M-130A) July 22, 1944 (H. E. Milliron).

Uranotaenia civinskii is named in honor of Stanley Civinski, who contributed greatly to the knowledge of the mosquitoes of Guadalcanal through a large number of valuable collections.

Variation

There is a marked variation in the extent and intensity of the light-scaling of the head of the adults, but normally the orbital light line is wide and a characteristic light cobalt blue. The light thoracic ornamentation is somewhat variable in extent and coloration. The light streak on the *stp* is normally almost a pure white but may show a bluish tinge. The light-scaling of the wing is also quite variable but is usually extensive and distinctly cobalt blue. The abdominal light-scaling is extremely variable. In the female it is rarely reduced on segments 2 and 3. In some specimens it is more extensive and includes a portion of segment 1 which in the majority of specimens is a lighter brown than the other dark portions of the abdomen. In the male, the light-scaling is usually confined to segments 3 and 4 and may be even reduced to segment 4 alone; a few specimens (including the allotype) show a small light patch on segment 2 also. This variation in the abdominal light-scaling is apparently an individual variation for I have not been able to correlate it with any other variation in the adults, any characters of the immature stages, or any differences in breeding areas. In any given collection all intergrades may be present, but usually the majority are either one or the other extreme. The light-scaling of the hind tarsi always includes the apex of segment 2 but is quite variable. In some specimens it includes only the extreme apex of this segment while in others it may extend basad for as much as one fourth of its length. The hind tarsal light-scaling is also more extensive or at least more conspicuous in the female. The fore and mid tarsi are extremely variable in coloration but, as in the holotype, they are usually distinctly lighter than the rest of the segments of the leg, and in a few specimens they are dingy white.

The variation in the chaetotaxy of the immature stages is shown in Tables 1 and 2. The range of variation is considerable, but no correlation of extremes could be made with any adult characters or between larva and pupa. No unusual variations were noted.

The New Georgia specimens agree very well with those from Guadalcanal in all stages. In specimens from Bougainville the subapical light patch on the outer face of the hind tibia of the female is more conspicuous, more distinctly white, and is usually prolonged basad as a streak. Since no other differences were noted in the Bougainville material and no individual rearings are available it appears best not to recognize this geographical variation as a distinct form for the present.

Specimens examined: 102M; 104F; 76P; 211L. Individual rearings: 11 larval.

Taxonomic Discussion

Uranotaenia civinskii is closely related to *U. argyrotarsis* Leicester, 1908, from Malaya, with which it has been confused in the past. The only other name proposed to date for members of this complex is *Pseudouranotaenia parangensis* Ludlow *in* Theobald, 1910, from the Philippines, synonymized by Edwards (1922: 460) with *U. argyrotarsis*. Edwards (1929: 312–313) recognized a single male specimen from Guadalcanal as being a variety of *U. argyrotarsis* on the basis of the white-scaling of the hind tarsus embracing the apex of segment 2, but in his catalog (Edwards, 1932: 98) he no longer listed the Solomons material as distinct from typical *U. argyrotarsis*. Baisas (1935: 65) found Philippine specimens, presumably conspecific with *P. parangensis*, agreeing with the description of the Solomons male in the coloration of the hind tarsus.

Leicester's original description of *U. argyrotarsis* (1908: 214–215) did not mention the characteristic, although inconspicuous, modification of the hind tibia of the male. Edwards (1929: 313), in comparing the Solomons male, noted this characteristic on Leicester's type specimen, and Baisas mentions it in the Philippine material. It appears, therefore, that the three geographical forms belong to the same species complex. No other species with such a modification of the hind tibia in the male has been described from the Australasian or Oriental regions. In the Ethiopian region, *U. pallidocephala* Theobald, 1908, has a similar but more complex modification of the base of the hind tibia, but this species is markedly different in a multitude of characters.

U. civinskii differs in the adult stage from the typical *U. argyrotarsis* from Malaya in the following characters: hind tarsus white-scaled from apex of segment 2 in both sexes; abdominal light-scaling usually absent or greatly reduced on segment 1 in the female as well as in the male; hind tibia of female with a light subapical patch on external face. It agrees with the Philippine material in the first character but apparently disagrees in the other two.

The larval stage has not been described from Malaya, and the description of Philippine material (Baisas, 1935: 65) is not sufficiently detailed to separate *U. civinskii*. The characters mentioned by Baisas fall within the range of variation of *U. civinskii*.

The pupal stage of members of this complex has been figured for Philippine material by Knight and Chamberlain (1948: 9, fig. 15) and described and figured for New Guinea material by Penn (1949: 33–35, fig. 18). Although the figures agree in general features, there is a marked difference in hair 1-II and many minor differences in branching. Penn's material agrees with the Solomons specimens in having hair 1-II secondarily branched whereas it is only primarily branched in the Philippine specimen. There are differences too between the New Guinea and Solomons material, the principal being the greater number of branches of hair 1-III, the greater length of hairs 4-V–VII, and the absence of a conspicuous external angle on the paddle in the Solomons form.

On the basis of the above-mentioned differences, *U. civinskii* appears to be quite distinct from members of the *U. argyrotarsis* complex from Malaya, Philippines, and New Guinea. Whether or not forms from the latter two regions are distinct from the typical *U. argyrotarsis* remains to be determined when more material is available, but it appears that they will prove to be distinct.

Biology

U. civinskii is predominantly a jungle-stream breeder, utilizing side pools and rock pools in stream beds in preference to other habitats. It apparently requires fresh, well-oxygenated, clear water because, if it is found in swamps or small pools, these are usually fed by springs or are in seepage areas. Because of this requirement it is difficult to rear under artificial conditions. It is usually found in densely shaded areas, but when flushed

into open situations it appears to survive successfully.

Living larvae can usually be recognized in the field by the long siphon and moderately pigmented head whereas living pupae can be distinguished by the moderately long, uniformly dark trumpet and long hairs 4-V–VII.

Both males and females are abundantly found in the vicinity of breeding places and fly readily in the daytime. They rest most frequently on shaded, moist rock surfaces and stream banks but have been found also on tree buttresses. A small number of males and females were collected in night hand catches at lighted quarters.

Distribution

SOLOMON ISLANDS, *Guadalcanal:* Tenaru, 1M, 1P, Aug. 27, 1928 (R. W. Paine) [Paine and Edwards, 1929]; generally distributed throughout the year on north-central and northwest coast (JNB *et al.*, J. G. Franclemont, K. L. Knight, P. W. Oman, A. B. Gurney, H. E. Milliron *et al.*) [USNM, CU, JNB]. *Florida:* Halavo, 2M, 2F(K-841), 1F (K-846) Dec. 17, 1943 (K. L. Knight) [USNM]. *Russell:* 4M, 2F, 1944 (R. B. Eads); Banika, 10L, Mar. 1943 (W. G. Downs) [USNM]. *New Georgia:* Segi Pt., 6M, 9F (B-116) (C. O. Berg) [USNM]; Munda Pt., 4M, 4F(F-17); 8M, 11F(F-20); 6L, Feb. 17, 1944 (J. G. Franclemont) [USNM, JNB], *Bougainville:* Empress Augusta Bay, 1M, 1F. no date; 5M, 5F, Mar. 1, 1944; 2M, 2F, Mar. 4, 1944 (C. R. Bruck); 1F(G-141) Jan. 25, 1944; 2F(G-226) Feb. 19, 1944; 1L(G-310) no date; 1M, 1F(G-325) Apr. 14, 1944; 1M, 1F(G-341) Apr. 23, 1944; 1M(G-349) no date; 1M(G-358) Apr. 27, 1944; 1M(G-388) May 22, 1944; 2L(G-400) June 12, 1944; 1M, 2F(G-402) June 14, 1944; 2M, 2F(G-422) June 27, 1944; 3M, 1F(G-436) July 18, 1944 (A. B. Gurney) [USNM, JNB].

4. *Uranotaenia solomonis* Belkin n. sp.
Plates 7, 8

1929. ?*Uranotaenia albescens* Taylor. Paine *in* Paine and Edwards, Bul. Ent. Res. 20: 304 (misident.).

1944. *Uranotaenia albescens* Taylor. Knight, Bohart, and Bohart, Keys Mosq. Australasian Reg. p. 15, 68 (*partim*).

Diagnosis

ADULT.—Head dark centrally; very narrow white orbital line, not expanded laterally; no erect occipital scales; conspicuous white frontal tuft. Narrow supra-alar line of white scales long, almost reaching scutal angle; *apn* and *stp* each with narrow line of white scales forming streak in line with white-scaling of head. Hind tarsus cream-white beyond middle of segment 3. Wing with white scales on base of R, Cu, and a few on 1A. Abdominal tergites 1–3 broadly white-scaled, 4 with apical median patch, 5 with narrow apical transverse band extending to sternite. *Male* legs without striking modifications.

PUPA.—Trumpet length 4.0 median width; tracheoid extending to about 0.5; uniformly darkly pigmented; slit in meatus. Hair 1-II usually 10, 11b, all primary; 4-V–VIII usually 4–6b, shorter than following tergite. Paddle serrations distinct on apical half of external margin.

LARVA.—Head longer than wide; hairs 5, 6-C strong spikes; 4-C short, 3, 4b; 7-C 4b(3–5); 9-C long, 3b(2–4). Antennal hairs simple; hair 1-A short, basad of middle. Thorax and abdomen with strong dorsal and ventral stellate tufts. Thoracic hairs 9, 10-P well developed; hairs 9-M, T, 8-M, 7-T long, multiple, barbed; 4-P 2b; 7-P 2b(2–3); 9-P 2b(2–3); 14-P single; long hairs with apices attenuated. Abdominal hairs 6-III–VIII stellate, much shorter than 6-I, II, without basal tubercles; 1-I, II 6–8b(4–11); 6-I, II 3b, branches uneven; 6-II, IV 7–11b. Comb plates separate; scales fringed. Siphon index about 4.0; pecten extending to 0.45; pecten teeth very broad, fringed apically and laterally, 11(11–13); hair 1-S moderate 10, 11b(9–13), uneven; valves moderate; hair 9-S weak, hook-like; 13-S moderate, twisted at base. Anal

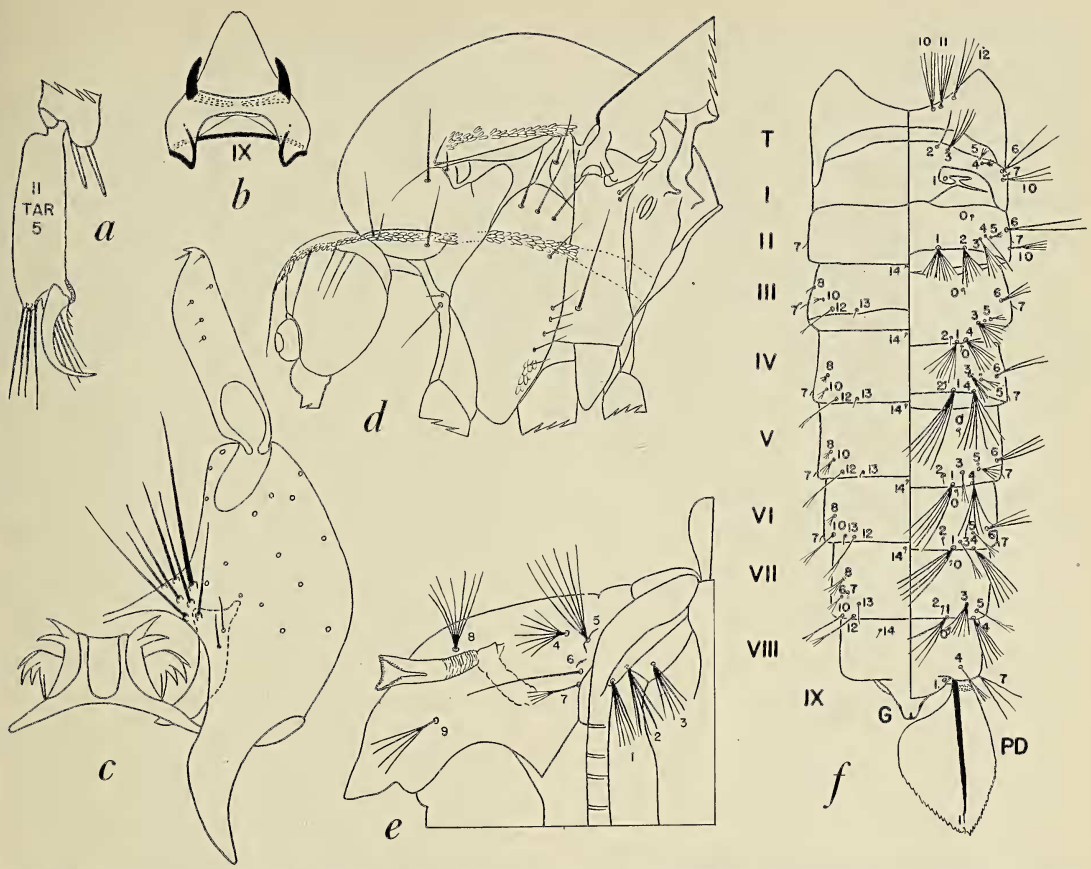

FIG. 7. *Uranotaenia solomonis* Belkin n. sp. *a–d*, Adult; *e*, *f*, pupa. *a*, Detail of mesothoracic leg of male; *b*, ninth tergite of male; *c*, male genitalia; *d*, left lateral aspect of head and thorax of female; *e*, right lateral aspect of anterior portion of cephalothorax of pupa; *f*, metanotum and abdomen of male pupa, left ventral, right dorsal. Abbreviations as given on page 314.

segment long; saddle margin with moderate apical spines; gills about 0.6 of saddle length; hair 1-X 5b(5–7), moderate; 2-X 3b; 3-X 2b; 4a-X 3b; 4b-X 2b.

Description

FEMALE (300–212).—Wing: 1.70 mm. Abdomen: about 1.10 mm. Proboscis: 1.10 mm. Front femur: 1.25 mm.

Head: Conspicuous frontal tuft of elongate white scales partly overlaid by elongate dark scales; very narrow orbital line of broader white scales partly overlaid by elongate dark scales, produced as narrow line toward *apn* laterally; recumbent dark scales broader caudad, conspicuously iridescent in a posterior patch, almost black in front; short erect scales restricted to extreme caudal part of occiput, apparently three pairs or more; occipitals dark, 1:3. Clypeus very dark. Palpus about 0.08 of proboscis; with small dark scales and numerous long hairs. Proboscis slightly swollen apically, dark-scaled, appearing lighter ventrally; short hairs on shaft and on apex; labella light brown, moderately hairy. Antenna about 1.2 of proboscis; torus very dark, with a few small hairs mesally; flagellum dark, about six bristles in whorl; hairs and scales scanty at base, longer and more numerous apically; apical segments gradually lengthened, ultimate only slightly longer than penultimate.

Thorax: Scutal integument uniformly dark brown; dense vestiture of recumbent narrow

elongate bronzy scales, somewhat broader in prescutellar space; narrow supra-alar line of white scales as figured, anterior scales small, moderately elongate, becoming larger caudally and forming a small tuft in front of wing root; acrostichals strong, other bristles strong, all dark. Scutellum brown; median lobe prominent, with four strong and one weak bristle, completely covered with short broad scales projecting slightly over base of bristles; lateral lobe with one weak and three stong bristles, completely covered with more elongate scales projecting strongly over base of bristles. Postnotum uniformly dark brown. Pleural integument dark brown, light iridescent areas in line with white-scaling; scaling and chaetotaxy as figured; scales white; line on *apn* very narrow, anterior scales short, posterior forming a tuft; sternopleural line with recumbent scales becoming semierect caudally, three or four scales in row, scales moderately elongate; one sternopleural patch restricted to lower part, scales white; bristles very dark and strong. Haltere brown at base and stem, dark-scaled on knob.

Wing: Distance between crossveins about 2.0 of *m-cu*. Vein R_2 about 0.43 of R_{2+3}; vein M_{1+2} about 0.8 of M beyond *m-cu*. Flat white scales dorsally on caudal margin of R to slightly beyond arculus and at extreme base of anterior margin of R; similar scales on basal 0.5–0.6 of Cu; a few white scales on base of 1A; two or three white scales on extreme base of C; remaining dorsal scales dark, strongly iridescent on anterior margin; fringe light, darker on apex.

Legs: Coxae and trochanters dark brown, with translucent scales except for flat white scales proximally on fore and mid coxae; femora dark-scaled above, light-scaled below; tibiae dark above, appearing lighter below; fore and mid tarsi dark basally, lighter apically, particularly below; hind tarsus distinctly creamy white beyond middle of segment 3. Leg I: femur 1; tibia 1.10; tarsus 0.90, 0.42, 0.26, 0.10, 0.07. Leg II: femur 1.10, slightly swollen basally; tibia 1.44; tarsus 0.90, 0.48, 0.26, 0.13, 0.08. Leg III: femur 1.07; tibia 1.22; tarsus 1.12, 0.64, 0.50, 0.26, 0.09.

Abdomen: Tergite 1 white-scaled except for small sublateral patch of dark scales; tergites 2 and 3 with broad median white patch extending from base to apex; tergite 4 with median apical patch of white scales; tergite 5 with narrow apical transverse band of white scales extending to sternite; remainder of tergites dark-scaled; sternites with light brown to cream-colored scales.

MALE (671–31).—Wing: 1.50 mm. Proboscis: 1.20 mm. Front femur: 1.10 mm.

Generally very similar to female. Proboscis moderately swollen. Flagellar whorls about 0.4 of flagellum, about 30 bristles in whorl; penultimate segment about 3.0 of preceding, apical about 0.9 of penultimate. Leg I: femur 1; tibia 1.23; tarsus 0.68, 0.46, 0.25, 0.15, 0.09; claws equal, one broadened. Leg II: femur 1.15, strongly swollen basally; tibia 1.57; tarsus 0.98, 0.47, 0.24, 0.12, 0.09, segments 4 and 5 as figured; smaller claw invisible. Leg III: femur 1.12; tibia 1.41, apex slightly enlarged; tarsus 1.23, 0.76, 0.57, 0.30, 0.10, white-scaling on segment 3 less extensive than in female; claws as on foreleg.

MALE GENITALIA (671–31).—As figured. Proximal border of ninth tergite deeply and narrowly emarginate, sclerotization evanescent in emargination; apical border shallowly emarginate; lateral lobe in form of a long, slender, heavily sclerotized tooth, prolonged ventrad basally as a sclerotization; median bridge less than length of tooth, with a subapical sclerotization. Proctiger without distinct sclerotizations. Basal lobe of sidepiece with a dorsal group of one very strong, three medium, and two small bristles and a ventral group of one long and one short bristle. Clasper as figured. Mesosome with a complete dorsal sclerotization; apex with two sharp subequal spines; median part with a ventrolateral lobe bearing three teeth, middle one longer. Paramere slender at base, expanded in distal half and with a bifurcation apically.

PUPA (Exuviae of holotype, 300–212).—

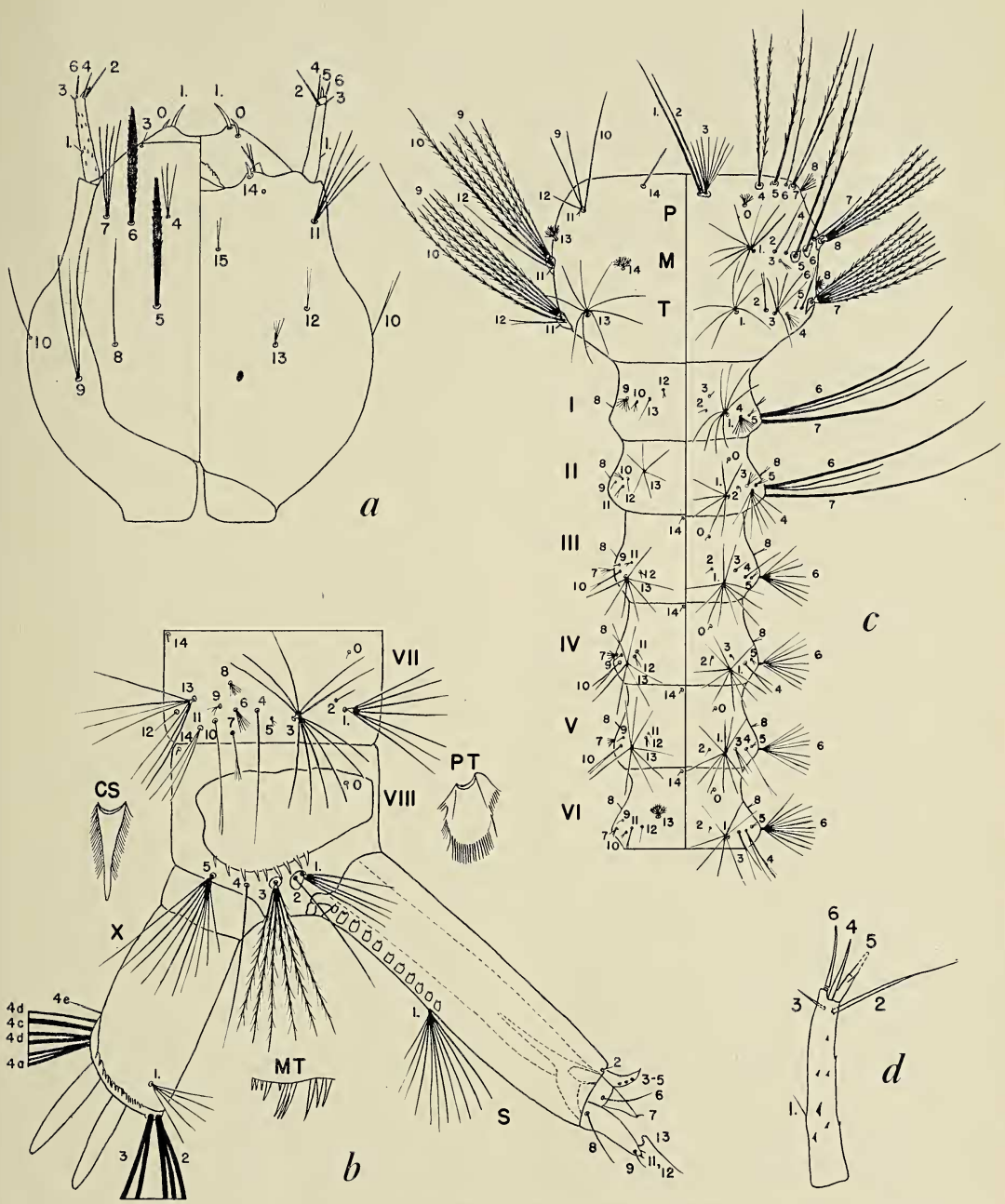

FIG. 8. *Uranotaenia solomonis* Belkin n. sp. Fourth instar larva. *a*, Head, left dorsal, right ventral; *b*, left lateral aspect of distal abdominal segments; *c*, thorax and proximal abdominal segments, left ventral, right dorsal; *d*, dorsal aspect of left antenna. Abbreviations as given on page 314.

Abdomen: 1.80 mm. Trumpet: 0.28 mm. Paddle: 0.52 mm.

Cephalothorax: Moderately pigmented; appendage cases, meso- and metanotum darker. Trumpet dark throughout; length 4.0 median width; gradually widened from base to about 0.4, then almost parallel-sided; inner wall distinctly separated except in pinna; tracheoid extending to about 0.5 on lateral surface, well developed on mesal surface; reticulate distinct, without conspicuous spicules; pinna 0.27; distinct mesal slit in meatus extending about 0.27 of trumpet length. Hairs lightly to moderately pigmented; relative position, length, and degree of development as figured; larger branched hairs with slender basal stalk only slightly expanded apically where branches arise. Hairs: 1(4, 5b), 2(5b), 3(3, 4b), 4(5, 7b), 5(6, 8b), 6(1), 7(4f), 8(6, 7b, external branches shorter), 9(4, 5b), 10(3b), 11(4b), 12(3b).

Abdomen: Moderately and uniformly pigmented, ventral intersegmental sclerotizations darker; tergites II–VII each with a posteromedian patch of distinct small spicules; tergite VIII with anteromedian patch of shorter, stronger spicules; tergal integumentary reticulations very faintly visible on I–IV, invisible caudally; sternites III–VII each with extensive median patch of small spicules; sternite II with caudal transverse band of lines of shorter, heavier spines; sternite VIII with anteromedian patch. All hairs moderately pigmented; relative position, length, and degree of development as figured; larger hairs as on cephalothorax. Segment I: hair 1(22, 26 primary branches, each branch densely barbed from near base, some apical barbs appearing as secondary branches; about as long as segment), 2(1), 3(4, 5b), 4(6b), 5(4, 5f), 6(2b), 7(2b), 10(4b). Segment II: hair 0(1), 1(8, 10b), 2(6, 5b), 3(6, 7b), 4(1), 5(4, 5f), 6(2b), 7(1), 10(4, 5b), 12(0). Segment III: hair 0(1), 1(8, 9b), 2(1), 3(9b), 4(6, 8b), 5(2, 3b), 6(3, 4b), 7(1), 8(2b), 10(3b), 12(1, 2f), 13(1), 14(1). Segment IV: hair 0(1), 1(7, 8b), 2(1), 3(7, 8b, long stem), 4(7, 9b), 5(2, 3f), 6(4b), 7(1), 8(4b), 10(3b), 12(2f), 13(1), 14(1). Segment V: hair 0(1), 1(6b), 2(1), 3(3, 4f), 4(6, 7b), 5(5, 6b), 6(3b), 7(1), 8(4b), 10(4, 5b), 12(2f), 13(1), 14(1). Segment VI: hair 0(1), 1(5b), 2(1), 3(2f), 4(5b), 5(3, 4f), 6(2, 3b), 7(1), 8(3, 5b), 10(3f), 12(2f), 13(1), 14(1). Segment VII: hair 0(1), 1(5b), 2(1), 3(6b), 4(4, 5b), 5(3f), 6(3b), 7(2, 3b), 8(3b), 10(2f), 12(3f), 13(1), 14(1). Segment VIII: caudal margin of sternite slightly emarginate; hair 0(1), 4(3f), 7(3, 4b), 14(1). Segment IX: hair 1(1, about 0.55 of segment length). Paddle as figured; lightly pigmented; midrib strongly sclerotized, evanescent apically; external buttress distinct proximally; basal pigment bar distinct; external margin with distinct serrations on apical half; internal margin with apical serrations gradually changing to larger, poorly sclerotized crenulations at about 0.12 from apex; hair 1 slender, elongate. Genital lobe extending to 0.22 of paddle, with large ventrocaudal patch of spicules. Anal segment indistinct; cercal sclerites well defined. Male genital lobe (exuviae of allotype, 671–31) extending to 0.22 of paddle; pair of large ventral patches of weak spicules; anal segment indistinct.

LARVA (Fourth instar exuviae of holotype, 300–212).—Head: 0.70 mm. Siphon: 0.60 mm. Anal saddle: 0.33 mm.

Head: Width 0.8 of length; ocular bulge moderately prominent; pigmentation extremely dark, except in ocular region; integumentary imbricate sculpturing very strong, uniform and distinct. Labrum moderate, 0.30 of width at 1-C, median emargination deeper than shown on figure. Mental plate small, with about 15 teeth. Hairs of head capsule darkly pigmented, conspicuous; 5, 6-C spike-like, deep black, apices frayed, shaft strongly spiculate, becoming barbed distally; 7, 9, 11-C with minute barbs; other hairs simple; relative position, length, and degree of development as figured. Hair 0(1, curved, sharply pointed, flattened and expanded laterally at base, reaching beyond base of 1-C), 1(1, moderately curved, sharply and abruptly pointed), 3(1, well developed and pigmented), 4(3b),

5(1, hair on right side forked at tip), 6(1), 7(3, 4b), 8(2f, strong), 9(3b), 10(2f, strong), 11(4, 5b), 12(2f), 13(5b), 14(1, short, irregular, flattened and lightly pigmented), 15(not seen). Antenna 0.22 of head; shaft wide at base, gradually and irregularly narrowed to apex; width at middle about 0.15 of length; uniformly and extremely darkly pigmented; spicules small, dark, sparse. Antennal hairs strongly pigmented, except apex of 5-A; relative position, length, and degree of development as figured; all single; 1-A placed at 0.37 from base, stiff, length 1.1 of antennal width. *Thorax:* All hairs and tubercles very strongly pigmented; relative position, length, and degree of development as figured; apices of long hairs attenuated; barbs when present numerous and strong; hair 5-P about 0.8 of head length. Prothorax: hair 0(9b), 1(1), 2(1), 3(8b, short expanded base), 4(2b), 5(1), 6(1), 7(2b), 8(7b), 9(2b, strong), 10(1), 11(3f), 12(1), 14(1, minutely spiculate). Mesothorax: hair 1(8, 9b), 2(1), 3(3, 4fb), 4(3f), 5(1), 6(1), 7(1), 8(6b), 9(4, 5b), 10(1), 11(1), 12(1), 13 (34, 35d), 14(37, 39d). Metathorax: hair 1(7b), 2(2f), 3(6b), 4(4b), 5(1), 6(2f), 7(7b), 8(15, 17b), 9(5b), 10(1), 11(1), 12(2f), 13(9, 11b). *Abdomen:* Tubercles and hairs of all segments strongly pigmented; relative position, length, and degree of development as figured; barbs when present long, conspicuous. Stellate hairs (1, 6, 13) with equal branches; 4-II a stellate hair. Segment I: hair 1(7b), 2(1), 3(1), 4(9, 11b), 5(3b), 6(3b, two lower branches shorter), 7(1), 8(2b), 9(7, 8b), 10(2, 4f), 12(2f), 13(2f). Segment II: hair 0(1), 1(6b), 2(1), 3(3, 4b), 4(6, 7b), 5(2, 3b), 6(3b, two lower branches shorter), 7(1), 8(1), 9(1), 10(3b), 11(2f), 12(1), 13(6b). Segment III: hair 0(1), 1(7, 8b), 2(1), 3(2, 3f), 4(1), 5(2, 3b), 6(7b), 7(4, 5b), 8(1, 2f), 9(1, 2b), 10(2f), 11(2, 3f), 12(1, 2b), 13(7b), 14(1). Segment IV: hair 0(1), 1(8b), 2(1), 3(1), 4(2b), 5(2, 3b), 6(7, 9b), 7(4, 5b), 8(2, 3b), 9(1), 10(2b), 11(1), 12(2b), 13(7b), 14(1). Segment V: hair 0(1), 1(7, 8b), 2(1), 3(2, 3b), 4(1, 2f), 5(2b), 6(9b), 7(6b), 8(2, 3b), 9(2f), 10(2b), 11(1), 12(1, 2b), 13(7, 8b), 14(1). Segment VI: hair 0(1), 1(6, 7b), 2(1), 3(2, 3f), 4(2b), 5(2b), 6(8, 10b), 7(2, 3b), 8(2f), 9(1), 10(2f), 11(2f), 12(2, 3f), 13(23, 27d), 14(1). Segment VII: hair 0(1), 1(6, 7b), 2(1), 3(11b), 4(2f), 5(2, 3b), 6(7b), 7(4, 5f), 8(7b), 9(2b), 10(1), 11(3b), 12(1), 13(6, 7b), 14(1). Segment VIII: comb plate heavily sclerotized, moderately pigmented, ornamented with numerous imbrications without distinct spicules; comb scales 7–8, median ones longer, sharply pointed, with conspicuous lateral fringe in basal 0.6 as figured; hair 0(1) ,1(5b), 2(2f), 3(6b), 4(2f), 5(8, 9b, branches uneven), 14(1). Siphon: as figured; median width 4.0 of length; heavily pigmented, darker dorsally at base, ornamented with imbrications as on comb plate, fainter apically; pecten extending to 0.45, teeth 11–11 with lateral apical and external fringe as figured; valves as figured, very darkly pigmented, ventral valve moderate; hair 1(11b, basal expansion asymmetrical and short, no distinct barbs), 2(broken off), 3–5 (not visible), 6(1, well developed, about as long as valve), 7(1, slender and conspicuous), 8(1, well developed, about as long as valve), 9(1, very weak, hook-like), 10–12 (not visible), 13(1, strong, twisted at base, longer than valve). Segment X: saddle strongly pigmented, darker dorsoapically, imbrications slightly weaker than on comb plate except distally; median width 0.54 of length; caudal margin with sparse spines of varying lengths, proximal ones arising from imbrications; gills slender, rounded apically, about 0.6 of saddle length; hair 1(5b, about 0.5 of saddle length), 2(3b, about 2.6 of saddle length), 3(2b, about 3.3 of saddle length), 4a(3b, about 1.6 of saddle length), 4b(2b, about 2.0 of saddle length), 4c(1, about 2.7 of saddle length), 4d(1, about 1.4 of saddle length), 4e(1, about 0.3 of saddle length).

Types

USNM No. 61,419 (holotype, allotype, paratypes). Paratypes to be deposited in BMNH, CU, and CSIR (Canberra); also in coll. JNB.

HOLOTYPE FLP(300–212), *Guadalcanal*, Lunga, Apr. 4, 1944 (Brackins), ALLOTYPE MLP(671–31), *Guadalcanal:* Tassi Creek, mouth of Bonegi River, Oct. 9, 1944 (V. R. Roa, F. B. Wysocki).

PARATYPES (117M; 138F; 74P; 387L; 34 individual rearings) all collected in various localities on north and northwest coast of *Guadalcanal* as follows: 1M(2), 2M(4), 1M (4–1), 3M, 1F(4–2), 1M(6) Doma Cove, Oct. 21, 1943 (JNB); 1F(14–214) Still River, Doma Cove, Oct. 25, 1943 (JNB); 1F(30) Matanikau River valley, Nov. 11, 1943 (JNB); 1M(52) Burns Creek, Lunga, Nov. 18, 1943 (M. Cohen); 1F(64–3) Wrights Creek, Matanikau valley, Nov. 27, 1943 (JNB *et al.*); 1M, 3L(83), Matanikau River valley, Dec. 5, 1943 (JNB); 1MLP(85–22) La Sage Creek, Pt. Cruz, Dec. 6, 1943 (S. Civinski); 1F(99) Lunga, Dec. 13, 1943 (M. Cohen); 1F(100–12) Burns Creek, Lunga, Dec. 14, 1943 (F. B. Wysocki); 2MLP(114–211, 213), 1FLP(114–212), 2L(114–2) Butsavu Creek, Lunga valley, Jan. 3, 1944 (L. J. Lipovsky, F. B. Wysocki); 1F(144–2) Poha River valley, Jan. 13, 1944 (S. Civinski); 3M, 1F, 34L(218–2) Chacon swamp, Lunga valley, Feb. 21, 1944 (A. W. Barnes, F. B. Wysocki); 2L(219–2) Lankford swamp, Kukum, Feb. 21, 1944 (J. J. Cuccio); 2F(289–3) Chacon swamp, Lunga valley, Mar. 29, 1944 (JNB); 1M, 1F(296–3) same data as preceding (L. J. Lipovsky, F. B. Wysocki); 1F(300–2) same data as holotype; 15L(302) Chacon swamp, Lunga valley, Apr. 7, 1944 (M. Cohen); 1F(334–2) Tassafaronga swamp, Apr. 27, 1944 (S. Civinski); 1F(356–2) Belton Creek, Matanikau, May 6, 1944 (V. R. Roa, F. B. Wysocki); 1F, 2L(374–2) Kukum, May 11, 1944 (Brackins); 1L, 1P(387–3) Bonegi River, May 18, 1944 (J. J. Cuccio); 2L(401–3) Mamara, May 25, 1944 (S. Civinski); 1LP (424–11) Chacon swamp, Lunga valley, June 1, 1944 (JNB); 2L(455) Sally Creek, Doma Cove, June 14, 1944 (JNB); 1F, 1L(472–1) Poha River valley, July 6, 1944 (JNB, V. R. Roa, F. B. Wysocki); 3M, 1F(506–3) Kukum, July 18, 1944 (M. Cohen, F. B. Wysocki); 1MLP(564–51), 1M, 1L, 1P(564–5) West Poha swamp, Aug. 5, 1944 (V. R. Roa, F. B. Wysocki); 1F(599–2) same data, Aug. 12, 1944 (V. R. Roa, F. Wysocki); 1MLP(647–18), 1L(647–1) same data, Sept. 16, 1944 (V. R. Roa, F. B. Wysocki); 1MLP(654–14), 2FLP(654–15, 16), 1M, 1F(654) same data, Sept. 23, 1944 (V. R. Roa, F. B. Wysocki); 4FLP(671–32, 33, 34, 35), 3M, 6F, 9L, 9P (671–3) same data as allotype; 1MLP(676–394), 4FLP(676–34, 38, 39, 392), 7M, 12F, 8L(676–2) West Poha swamp, Oct. 16, 1944 (JNB, J. Laffoon); 2F(681–2) Chacon swamp, Lunga valley, Oct. 17, 1944 (JNB); 4MLP (708–105, 106, 110, 111), 7FLP(708–101, 102, 103, 104, 108, 109, 112), 20M, 10F, 64L, 21P (708–1), 1LP(708–107) West Poha swamp, Nov. 1, 1944 (JNB); 3MLP(713–14, 18, 19), 9M, 20F(713–1) same data, Nov. 3, 1944 (L. J. Lipovsky *et al.*); 2M, 5F, 18L(772–2) Chacon swamp, Lunga valley, Dec. 8, 1944 (L. J. Lipovsky, Shaw, Schultz); 12M, 8F(802–3) West Poha swamp, Jan. 5, 1945 (M. Cohen, C. Calloway, Williams); 21L(816–3) same locality, Jan. 12, 1945 (M. Cohen, F. B. Wysocki); 1F, 16L(837–3) same locality, Jan. 20, 1945 (J. J. Cuccio. F. B. Wysocki); 2M, 1F(846–2) Kukum, Jan. 30, 1945 (M. Cohen *et al.*); 1M(848–2) Kukum, Feb. 1, 1945 (J. J. Cuccio, C. Calloway, Williams); 1FLP(850–36), 2M, 3F(850–3) Lankford swamp, Kukum, Feb. 2, 3, 1945 (M. Cohen, J. J. Cuccio, F. B. Wysocki); 1FLP(921–302), 1L, 2P(921–3) West Poha swamp, Mar. 20, 1945 (JNB, M. Cohen, E. Winkler); 7M, 6F, 129L(958–2) same locality, Apr. 28, 1945 (J. J. Cuccio *et al.*); 1M(971–2) same locality, May 6, 1945 (JNB); 1F(1020) Lunga, night hand catch, Jan. 13, 1944 (M. Cohen); 1F(1145) Kukum, night hand catch, Apr. 5, 1944 (A. W. Barnes); 2M, 1F(1146) Kukum, night hand catch, Feb. 18, 1944 (J. J. Cuccio, F. B. Wysocki); 1M(1235) West Poha swamp, resting on tree buttress, July 18, 1944 (L. J. Lipovsky, F. B. Wysocki); 1F(1338) Lunga valley, night hand catch, Jan. 29, 1945 (Tyler); 1F(1373) Kukum, night hand catch, Mar. 12, 1945 (C.

S. Hollingshead, V. R. Roa); 1M(Sta. 5) Matanikau, night hand catch, Mar. 14, 1944 (M. Cohen); 4M, 9F, 11L, 3P, Tenaru, Oct. 18, 1943 (J. G. Franclemont); 3M(K-949) Aug. 24, 1943 (K. L. Knight); 1M(K-892) Dec. 26, 1943 (K. L. Knight); 1F(K-962) Dec. 27, 1943 (K. L. Knight); 1M, 2F, 4L(NMSS-29–39) Mar. 3, 1943 (Weathersby and Knapp); 1M(0–24) Sept. 10, 1943 (P. W. Oman); 1M(0–33) Sept. 10, 1943 (P. W. Oman); 2M, 3F(0–34) Sept. 10, 1943 (P. W. Oman); 1M, 2F(0–35) Sept. 13, 1943 (P. W. Oman); 1F(0–38) June 19, 1944 (P. W. Oman); 1L(K-889), 2L(K-908) (K. L. Knight); 1L, 1P(K-782) Oct. 14, 1943 (K. L. Knight).

Variation

The variation in the extent of the light-scaling of the head and thorax of adults of *U. solomonis* is much less than in any other species of *Uranotaenia* from the Solomons. The light scales are almost pure white, showing only rarely a faint bluish tinge, and are always arranged in narrow lines. The abdominal light-scaling shows a moderate variation but is always extensive on segments 1, 2, and 3. It is frequently greatly reduced on segment 4 and can be almost completely absent from this segment. The transverse apical white band on segment 5 is generally very prominent and reaches the sternite laterally, but in a few specimens it is not complete, perhaps due to a teneral condition. The white-scaling on segment 3 of the hind tarsus covers from one to two thirds of the segment. The light-scaling of the wing shows the usual variation in extent but is invariably white.

The variation in the chaetotaxy of immature stages is shown in Tables 1 and 2. There is more variation in the branching of the stellate hairs of the larva than in any other species studied. Extremes of variation frequently occur in the same collection and even in the same individual. The range of variation in the branching of pupal hairs is moderate. Two pupae have hair 12-II well developed, the only instance of the occurrence of this hair outside of *U. quadrimaculata*.

The majority of specimens from New Georgia show a reduction of the light-scaling on the abdomen with an almost complete absence of light-scaling on segment 4 and a corresponding weakening of the apical band on segment 5, particularly in the female. There is also in these specimens a more extensive white-scaling of segment 3 of the hind tarsus. This is more pronounced in the female, and in a few specimens there remains only a faint basal dorsal dark streak on this segment. I have not been able to find any constant differences in the immature stages in this material and, therefore, am regarding the New Georgia specimens as a local race for the present. The Bougainville specimens agree very well with the material from Guadalcanal.

Specimens examined: 163M; 194F; 89P; 478L. Individual rearings: 36 larval.

Taxonomic Discussion

Uranotaenia solomonis is closely related to *U. albescens* Taylor, 1914, described from Townsville, Queensland, and has been treated as a part of that species in the past (Paine and Edwards, 1929: 304; Edwards, 1932: 97; Lee, 1944: 19; and Knight, Bohart, and Bohart, 1944: 68). I have not seen specimens of Taylor's species, but from his description as well as Lee's figures of the larva of *U. albescens* from New Guinea (1944: 19) it appears that *U. solomonis* is at least a distinct subspecies.

The adults of *U. solomonis* appear to differ from *U. albescens* in the more extensive white-scaling on segment 3 of the hind tarsus as Taylor states that only its apex is white in *U. albescens*. If Taylor's description is correct, *U. solomonis* differs also in that it has a very narrow line of white scales on *apn* and less extensive scaling on abdominal segment 4 and perhaps also 5.

Taylor's description of the larva is not sufficiently detailed for comparison. It only indicates that the larvae of the two forms belong to the same group. Lee's figures (1944: 19)

of a specimen from Milne Bay, Papua, show striking differences from *U. solomonis*. In the latter the anal saddle is almost twice as long as its width instead of only slightly longer; hair 1-X is 5–7b instead of 3b; hair 3-X is 2b instead of single; hair 4a-X is 3b instead of 2b; hair 1-S is 10, 11b(9–13) instead of 6b.

Penn's description and figure (1949: 32–33, fig. 17) of a single male pupa of *U. albescens* from Milne Bay, Papua, indicates an entirely different species. On the basis of the long trumpet, peculiar hair 8-C, and elongate hairs 4-V–VII, as well as a number of other characters, I am convinced that Penn described a member of the *tibialis*-group as *U. albescens*.

Uranotaenia solomonis is very sharply separated from the other ornamented species of *Uranotaenia* from the Solomons in the structure of the mesosome of the male genitalia. The "lateral plates" are broadly joined dorsally by a heavily sclerotized bridge, and instead of the two simple teeth on each plate there are two teeth apically and a ventrolateral process bearing three teeth.

U. solomonis and *U. albescens* appear to form a species complex peculiar to the Papuan subregion. This complex may be related to *U. campestris* Leicester, 1908, from Malaya and *U. arguellesi* Baisas, 1935, from the Philippines. The latter resemble *U. solomonis* in abdominal ornamentation but differ in lacking the white-scaling on the hind tarsus and in having distinctly bluish scales on the head and thorax. Another related species may be *U. macfarlanei* Edwards, 1914, which has been reported from Okinawa, China, Hongkong, Java, Sumatra, Malay Peninsula, and Assam. This species agrees with *U. solomonis* in having the light-scaling white but is distinct in abdominal ornamentation and the absence of the white-scaling of the hind tarsus.

Biology

Uranotaenia solomonis is the commonest *Uranotaenia* of the Solomons breeding in ground pools. Usually it is found in rather open situations, but it will tolerate considerable shade. It frequently breeds in temporary pools, ruts, springs, and streams and is common in somewhat open parts of dense jungle swamps. Stagnant foul water is no deterrent to its breeding, and it has been collected even in tin cans. It is interesting to note in connection with the latter that *U. albescens* has been also collected in artificial containers (Taylor, 1914: 706).

This species has such a wide range of breeding habitats that it has been found associated with practically every species of mosquito utilizing ground water on Guadalcanal. It is often found with *Anopheles farauti* Laveran, 1902, and *A. punctulatus* Donitz, 1901, but has a wider range of habitats than even *Culex annulirostris* Skuse, 1889.

Living larvae are fairly easily distinguished in the field from other ground-water *Uranotaenia* by their long siphon, black head and antenna, and normally light-colored bodies. *U. sexaueri* has a somewhat similar coloration, but the pigmentation of the head is not as strong. Living pupae have a moderately long trumpet (index 4), dark throughout and quite like that of *U. civinskii*, but can be distinguished from the latter in the field by the much shorter abdominal tufts 4-V–VII.

Adults of *U. solomonis* are commonly seen in jungle vegetation in proximity to their breeding places, usually resting close to the ground but also on tree buttresses. They do not appear to fly readily until darkness sets in. In routine night hand catches at lighted quarters they were collected more frequently than any other *Uranotaenia* on Guadalcanal, but this may be due to their greater relative abundance in the populated area.

Distribution

SOLOMON ISLANDS, *Guadalcanal:* Generally distributed throughout the year on north-central and northwest coast (JNB *et al.*, J. G. Franclemont, K. L. Knight, P. W. Oman, Weathersby and Knapp) [USNM, CU, JNB]. *Russell:* Banika, 1L, Mar. 1943 (W. G. Downs); 1F, 1944 (R. B. Eads) [USNM]. *New Georgia:*

Segi Pt., 1M(Be-54a) (C. O. Berg) [USNM]; Munda Pt., 10M, 20F(F-21) Dec. 1943; 4M, 2F, 7L, 2P(F-70) Feb. 14–17, 1944 (J. G. Franclemont) [USNM, JNB]. *Bougainville:* Empress Augusta Bay, 1M, 2F (C. R. Bruck); 9M, 9F(B-18) Mar. 4, 1944 (C. R. Bruck); 1F, 1944 (W. G. Downs); 2M, 4F(NMSS-29–1) Dec. 18, 1943 (Weathersby); 1L(G-175) Feb. 3, 1944; 1L(G-226) Feb. 19, 1944; 1F(G-247) Feb. 22, 1944; 7M, 2F, 1L, 4P (G-269n) Mar. 6, 1944; 17L(G-306) Mar. 29, 1944; 18L(G-310) Apr. 3, 1944; 1M(G-341); 1F(G-387); 2M, 1F, 9L(G-388) May 22, 1944; 4M, 4F(G-402) June 14, 1944; 1F(G-404a) July 1, 1944; 1F(G-412) June 19, 1944; 2M, 3F(G-436); 1F(G-438) (A. B. Gurney) [USNM, JNB].

5. ***Uranotaenia sexaueri*** Belkin n. sp.
Plates 9, 10

1944. *Uranotaenia nivipes* (Theobald). Knight, Bohart, and Bohart, Keys Mosq. Australasian Reg. p. 15 (*partim*).

Diagnosis

ADULT.—Head entirely white-scaled dorsally; small dark patch laterally; few erect verticals; frontal tuft conspicuous. Lower part of scutum and upper part of pleura white, including around the front, with extensive white-scaling; *apn*, *ppn*, and *stp* each with large patch of broad white scales; lower half of *stp* with dark scales. Hind tarsus white-scaled from about 0.5 of segment 3; fore and mid tarsi light on segments 3–5. Wing with conspicuous black and white pattern. Abdominal tergite 1 white-scaled, tergites 2–7 with apical transverse white bands, broader on basal segments. *Male* legs without striking modifications.

PUPA.—Trumpet length 3.5 median width; tracheoid extending to about 0.4; dark on tracheoid, golden brown beyond; slit in meatus. Hair 1-II 6–7b, all primary; 4-V–VII 4–6b, slightly longer than following tergite. Paddle serrations very indistinct, restricted to extreme apex on external margin.

LARVA.—Head markedly longer than wide; hairs 5, 6-C strong spikes; 4-C moderate 2b (2–3); 7-C 4b(3–5); 9-C long 4b(2–5). Antennal hairs simple; 1-A very short, near middle. Thorax and abdomen with well-developed dorsal and ventral hairs. Thoracic hair 10-P well developed; 9-P short 4b(4–6); 9-M, T, 8-M, 7-T long, multiple, barbed; 4-P 2b; 7-P 2b(2–4); 14-P very strong (12–16b); long single hairs with apices blunt or frayed. Abdominal hairs 6-III–VIII stellate, much shorter than 6-I, II, without basal tubercles; 1-I, II 7–9b(7–11); 6-I,II 2b, branches uneven; 6-III, IV 7–8b(7–11). Comb plates separate; scales fringed basally only, one or two median ones enlarged. Siphon index about 5.5; pecten extending to about 0.3; pecten teeth narrow, fringed apically and laterally; valves long; hair 1-S moderate, 7, 8b(6–9); 9-S weak, straight, inconspicuous; 13-S long, strong, twisted at base. Anal segment moderate; saddle margin with numerous moderate, narrow, apical spines; gills about 0.5 of saddle length; hair 1-X 6, 5b, moderate; 2-X 3b(2–4); 3-X 2b; 4a-X 3b; 4b-X 2b.

Description

FEMALE (713–15).—Wing: 1.55 mm. Abdomen: 1.10 mm. Proboscis: 1.15 mm. Front femur: 1.15 mm.

Head: Vertex with decumbent scales all white; central and caudal scales with faint iridescence; scales elongate but rounded apically; frontal tuft present but largely missing in specimen; erect occipital scales missing in specimen; inner orbital bristle absent, outer orbitals three. Postgena with an orbital patch of dark scales below orbital bristles, followed by grayish-brown scales. Clypeus dark brown. Palpus about 0.05 of proboscis, with small scales and long hairs. Proboscis slightly swollen on extreme apex; dark-scaled, lighter ventrally; shaft with short hairs laterally; just before apex a few long hairs, apex with numerous hairs; labella brown, with vestiture of light hairs. Antenna about 1.2 of proboscis; torus light brown, with a few short hairs dorsally

and mesally; flagellum darker; whorls short, with 6 bristles; hair and scales scanty basally, more numerous apically; apical segment with long light hairs, about 1.3 of penultimate.

Thorax: Integument extensively white laterally as indicated on figure, boundary of white integument and scales indicated by stippling. Median portion of scutum with brown integument and dense vestiture of recumbent narrow, elongate, bronzy-brown scales; lateral portions including a broad anterior border white-scaled; anterior acrostichal area with a patch of small, broad, recumbent white scales; lateral border in front of scutal angle with scaling denser than shown on figure; supra-alar scales elongate becoming very slender and forming a tuft in front of wing root; acrostichals unusually strong, dorsocentrals fewer than usual, supra-alars few in number, all bristles dark. Scutellum dark brown; median lobe short, partially denuded in specimen, scales short, rounded apically, projecting slightly over base of the three bristles; lateral lobe with three heavy bristles, longer than those on median lobe, scaling elongate, projecting strongly over bases of bristles. Postnotum dark brown centrally, cream-colored laterally. Pleural integument extensively white as indicated on figure, lower part brown; scaling and chaetotaxy as figured; *apn* entirely white, with elongate white scales; *ppn* with scattered small white scales, almost circular in outline; *stp* extensively scaled, scales of upper part white, dark on lower part, line of separation very sharp; larger bristles dark, smaller light, propleurals minute. Haltere white on base, darker on upper part of stem, knob dark-scaled.

Wing: Distance between crossveins about 1.7 of *m-cu*. Vein R_2 about 0.4 of R_{2+3}; vein M_{1+2} about 0.82 of M beyond *m-cu*. Conspicuous black and white pattern of scaling on dorsal surface; anterior border dark, median and posterior part white with a subapical transverse dark band, apex white beyond base of cell R_2; C dark except at base on caudal margin and at apex; R white at base for 0.3 of wing length, then dark to 0.42, followed by white to 0.56 and then dark to level of base of cell R_2; a subapical dark irregular transverse band including C, R, portion of R_{2+3} equal to corresponding dark area of R_1, five scales on R_{4+5} at 0.64–0.76, four scales on M at 0.65–0.75, five scales on Cu_1 at 0.63–0.74, Cu_2 from 0.65 to apex; two dark scales at preapical curvature of 1A. Fringe white.

Legs: Coxae and trochanters brown, scales not seen, larger bristles dark, smaller brown; femora dark-scaled, light ventrally; tibiae dark, appearing paler ventrally in some lights; first two segments of front and middle tarsi dark, apical three segments lighter; hind tarsus with apical 0.6 of segment 3 and entire segments 4 and 5 white-scaled, remainder dark above, lighter below. Leg I: femur 1; tibia about 1.0; tarsus 0.78, 0.40, 0.23, 0.14, 0.07. Leg II: femur 1.10, strongly swollen basally; tibia 1.43; tarsus 0.90, 0.42, 0.30, 0.10, 0.08. Leg III: femur 1.03; tibia 1.20; tarsus 1.06, 0.57, 0.43, 0.23, 0.10.

Abdomen: Tergite 1 almost entirely white-scaled; 2–5 each with apical transverse white band, broader in center where it occupies about 0.4 of segment; 6 and 7 with a few apical white scales; remainder of tergites dark-scaled; sternites with dull white scales.

MALE (713–12).—Wing: 1.40 mm. Proboscis: 0.98 mm. Front femur: 0.90 mm.

Generally very similar to female. Proboscis more strongly swollen at extreme apex. Flagellar whorls about 0.45 of flagellum, about 20 bristles in whorl; basal flagellar segments short, basal part slightly swollen; penultimate 2.0 of preceding, apical equal to penultimate. Leg I: femur 1; tibia 1.0; tarsus 0.63, 0.36, 0.26, 0.14, 0.08; claws equal, one broadened, other slender. Leg II: femur 1.13; tibia 1.50; tarsus 0.90, 0.41, 0.27, 0.10, 0.10, segment 4 with median ventral lobe projecting below 5, segment 5 with dorsoapical lateral lobes; claws unequal, enlarged, smaller about 0.5 of larger, both strongly curved. Leg III: femur 1.13; tibia 1.30; tarsus 1.15, 0.60, 0.45, 0.25, 0.09; claws as on foreleg. Abdominal tergite

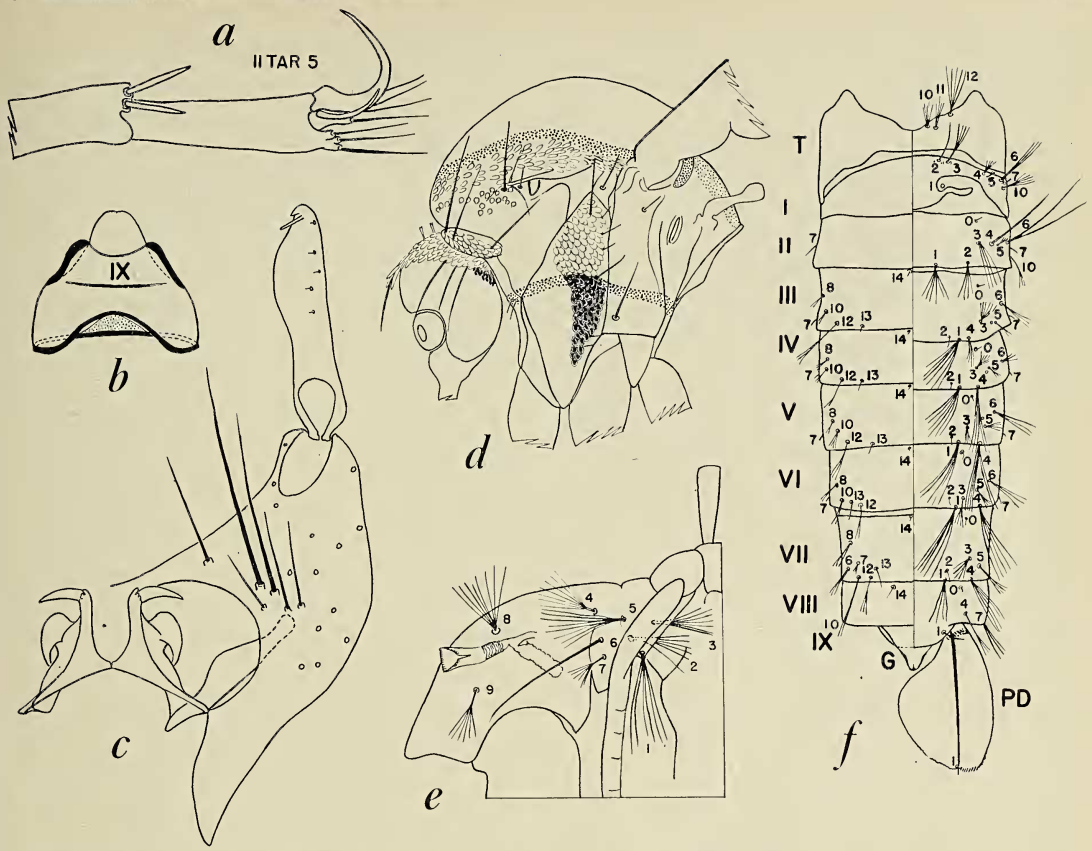

FIG. 9. *Uranotaenia sexaueri* Belkin n. sp. *a–d*, Adult; *e*, *f*, pupa. *a*, Detail of mesothoracic leg of male; *b*, ninth tergite of male; *c*, male genitalia; *d*, left lateral aspect of head and thorax of female; *e*, right lateral aspect of anterior portion of cephalothorax of pupa; *f*, metanotum and abdomen of male pupa, left ventral, right dorsal. Abbreviations as given on page 314.

1 white-scaled as in female; tergites 2–7 less extensively white-scaled, apical bands narrower.

MALE GENITALIA (713–12).—As figured. Ninth tergite long, without bristles; proximal part shallowly emarginate; apex broadly but shallowly emarginate; lateral lobes slightly projecting, with ventrolateral sclerotization. Proctiger without visible sclerotization. Basal lobe of sidepiece with a dorsal group of two strong bristles and three weak ones and one strong ventral bristle. Clasper as figured. Mesosome expanded on each side into a broad, basal, heavily sclerotized plate on ventral surface; apical spine slightly curved, projecting laterad; median spine heavy at base, strongly curved inward and with a basal tooth. Paramere expanded near base.

PUPA (Exuviae of holotype, 713–15).—Abdomen: 1.62 mm. Trumpet: 0.20 mm. Paddle: 0.42 mm.

Cephalothorax: Uniformly moderately pigmented, darker on meso- and metanotum and bases of wing and appendage cases. Trumpet dark on tracheoid, golden brown beyond; length 3.50 median width; gradually widened from base, almost parallel-sided on apical half; inner wall distinctly separated only in tracheoid portion; tracheoid extending about 0.4; reticulations distinct; pinna about 0.25; a distinct slit in meatus extending about one-half distance of reticulate. All hairs moderately pigmented and simple; relative position, length, and degree of development as figured; larger branched hairs with a short stem only slightly flattened apically where branches arise.

Hairs: 1(6b), 2(5, 6b), 3(5, 6b), 4(7b), 5(8, 9b), 6(1), 7(6f), 8(7, 8b), 9(7, 8b), 10(5, 6b), 11(4, 5b), 12(4, 5b).

Abdomen: Uniformly moderately pigmented throughout; tergites II–VII each with a large posteromedian patch of distinct small spicules; tergite VIII with a similar patch anteromedially; tergites II–VIII with distinct polygonal reticulations, more obvious on caudal segments; sternites III–VIII each with extensive median patch of small spicules; sternite II with extensive posteromedian area covered with numerous short, transverse, arcuate lines of more heavily sclerotized spicules. All hairs moderately pigmented; relative position, length, and degree of development as figured; larger branched hairs without strong basal plates, branching taking place short distance from base. Segment I: hair 1(about 17 primary branches, moderate number of strong secondary branches; about 0.85 length of tergite), 2(1), 3(3b), 4(4b), 5(5, 6b), 6(4b), 7(1, 2f), 10(4, 5f). Segment II: hair 0(1), 1(8b), 2(4, 5b), 3(5b), 4(1), 5(3, 4f), 6(2b), 7(1), 10(3f). Segment III: hair 0(1), 1(7b), 2(1), 3(6, 7b), 4(4, 5b), 5(3, 4f), 6(2, 3b), 7(1), 8(3f), 10(2f), 12(2, 3f), 13(1), 14(1). Segment IV: hair 0(1), 1(6b), 2(1), 3(5, 6b), 4(6b), 5(3f), 6(2, 3b), 7(1), 8(1, 2b), 10(1, 2f), 12(2f), 13(1), 14(1). Segment V: hair 0(1), 1(5, 6b), 2(1), 3(3, 5f), 4(4, 6b), 5(3, 4b), 6(2, 3b), 7(1), 8(1, 3f), 10(4b), 12(2f), 13(1), 14(1). Segment VI: hair 0(1), 1(4, 5b), 2(1), 3(3, 4f), 4(4, 5b), 5(5f), 6(3b), 7(1), 8(2, 3f), 10(2f), 12(2, 3f), 13(1), 14(1). Segment VII: hair 0(1), 1(3, 4b), 2(1), 3(4, 5b), 4(4, 5b), 5(2, 4f), 6(2, 3b), 7(3b), 8(3, 4b), 10(2f), 12(2f), 13(1), 14(1). Segment VIII: caudal margin of sternite truncate; hair 0(1), 4(2, 3f), 7(2, 3b), 14(1). Segment IX: hair 1(1, 0.67 of segment length). Paddle as figured; lightly pigmented; midrib strongly sclerotized; external buttress poorly defined; basal pigment bar distinct; external margin with small teeth distinct apically only; internal margin with even shorter teeth; hair 1 extremely weak and short. Genital lobe extending to about 0.3 of paddle; with ventrocaudal patch of strong spicules. Anal segment indistinct. Male genital lobe (exuviae of allotype, 713–12) extending to 0.3 of paddle; pair of large ventral lateral patches of strong spicules; anal segment indistinct, extending just beyond apex of IX.

LARVA (Fourth instar exuviae of holotype, 713–15).—Head: 0.65 mm. Siphon: 0.70 mm. Anal saddle: 0.36 mm.

Head: Width 0.7 of length; ocular bulge prominent; darkly and uniformly pigmented except for light ocular areas; integumentary imbricate sculpturing very prominent and uniform. Labrum short, 0.25 of width at 1-C, anterior margin very deeply emarginate. Mental plate with 15 blunt teeth, conspicuously defined apically only. Hairs of head capsule well pigmented, conspicuous; 5, 6-C spikelike, very darkly pigmented, apices frayed, shaft minutely spiculate; 7, 11-C minutely barbed, other hairs simple; relative position, length, and degree of development as figured. Hair 0(1, slender, only slightly flattened, reaching beyond base of 1-C), 1(1, curved, bluntly pointed), 3(1, minute stiff spine), 4(2b), 5(1), 6(1), 7(4b), 8(3, 4f), 9(4b), 10(2f), 11(8b), 12(3f), 13(6, 7b), 14(1, short, heavily sclerotized, expanded spine), 15(3, 4b). Antenna 0.23 of head; shaft of rather uniform width, but irregular; width at middle about 0.15 of length; uniformly darkly pigmented; spicules small and sparse. Antennal hairs well pigmented except 5-A; relative position, length, and degree of development as figured; all single; 1-A placed at middle, length 0.75 of antennal width.

Thorax: All hairs and tubercles well pigmented; relative position, length, and degree of development as figured; apices of long hairs frayed or blunt, appearing as if broken off; barbs when present numerous, slender, and lightly pigmented; hair 5-P about 0.8 of head length. Prothorax: hair 0(15, 16d), 1(1), 2(1), 3(broken off), 4(2b), 5(1), 6(1), 7(2b), 8(8, 9b), 9(4b, equal), 10(1), 11(2, 3b), 12(1), 14(14b, large symmetrical semilunar expand-

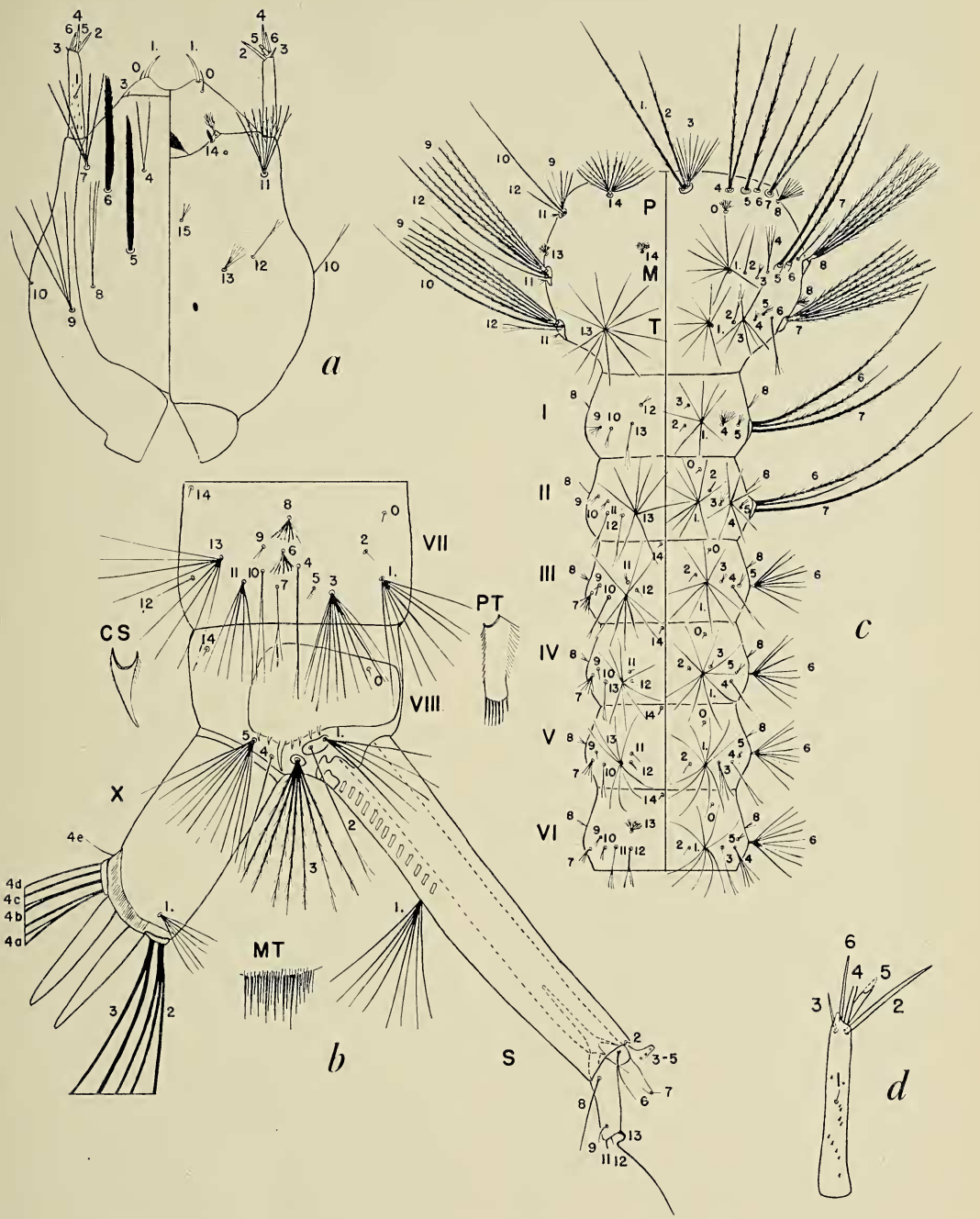

FIG. 10. *Uranotaenia sexaueri* Belkin n. sp. Fourth instar larva. *a*, Head, left dorsal, right ventral; *b*, left lateral aspect of distal abdominal segments; *c*, thorax and proximal abdominal segments, left ventral, right dorsal; *d*, dorsal aspect of left antenna. Abbreviations as given on page 314.

ed base). Mesothorax: hair 1(broken off), 2(1), 3(3bf), 4(4f), 5(1), 6(1), 7(2f), 8(broken off), 9(5b), 10(1), 11(5b), 12(1), 13(28, 30d), 14(24, 30d). Metathorax: hair 1(9b), 2(3f), 3(4, 5b), 4(2b), 5(2b), 6(2, 3f), 7(8b), 8(11d), 9(6b), 10(1), 11(3, 4f), 12(1, 2f), 13(13b).

Abdomen: Large hairs and tubercles of segments I and II well pigmented; hairs of following segments moderately pigmented; relative position, length, and degree of development as figured; barbs when present slender and lightly pigmented. Stellate hairs (1, 6, 13) with equal branches; 4-II a stellate hair. Segment I: hair 1(broken off), 2(1), 3(1), 4(10, 13b), 5(2, 3b), 6(2b), 7(1), 8(1, 2f), 9(5b), 10(2, 3f), 12(1, 2f), 13(1, 2f). Segment II: hair 0(1), 1(broken off), 2(1), 3(2, 3b), 4(6b), 5(3b), 6(2b, one side lower branch 3f), 7(1), 8(1), 9(3b), 10(2, 3b), 11(1, 2f), 12(1), 13(7b). Segment III: hair 0(1), 1(broken off), 2(1), 3(2, 3b), 4(1), 5(2b), 6(7b), 7(4, 5b), 8(1, 3f), 9(2b), 10(1, 3f), 11(2, 3b), 12(1, 2b), 13(7b), 14(1). Segment IV: hair 0(1), 1(broken off), 2(1), 3(1), 4(2f), 5(2, 3b), 6(8b), 7(4, 5b), 8(2, 3f), 9(1, 2b), 10(1, 3f), 11(1), 12(2b), 13(7, 8b), 14(1). Segment V: hair 0(1), 1(9b), 2(1), 3(4b), 4(1), 5(2b), 6(broken off), 7(3b), 8(1, 2f), 9(2b), 10(1), 11(1), 12(1), 13(broken off), 14(1). Segment VI: hair 0(1), 1(broken off), 2(1), 3(2f), 4(4b), 5(1), 6(8b), 7(3b), 8(2f), 9(1), 10(2b), 11(3f), 12(3f), 13(20, 22d), 14(1). Segment VII: hair 0(1), 1(broken off), 2(1), 3(broken off), 4(broken off), 5(3b), 6(6–7b), 7(1, 2f), 8(6b), 9(3b), 10(broken off), 11(4b), 12(1), 13(9b), 14(1). Segment VIII: comb plate heavily sclerotized, well pigmented, ornamented with numerous imbrications, without visible spicules (at 430 ×); comb scales 6–7, second and third from most ventral greatly enlarged, very sharply pointed, with very inconspicuous basal lateral fringe as figured; hair 0(1), 1(5b), 2(broken off), 3(broken off), 4(broken off), 5(8b), 14(1, exceptionally long). Siphon: as figured; length 5.5 median width; uniformly darkly pigmented, ornamented with imbrications as on comb plate; pecten extending to about 0.3, teeth 12–14 with lateral and apical fringe as figured; valves as figured, ventral valve exceptionally long; hair 1(8, 9b, no conspicuous basal expansion, barbs absent), 2(1, short, slender), 3–5 (apparently all present as setal rings, 3 closer to apex of valve than usual), 6(1, well developed, longer than valve), 7(1, slender but conspicuous), 8(1, straight, slender, about as long as valve), 9(1, weak, straight, inconspicuous), 10–12 (not seen), 13(1, very strong, twisted at base, longer than valve). Segment X: saddle well pigmented, darker dorsad; ornamented with imbrications as on comb plate; median width about 0.5 of length; caudal margin with numerous sharply pointed spines, proximally smaller and appearing to arise from apical imbrications; gills about 0.5 saddle length, narrow, bluntly pointed at apex; hair 1(6b, about 0.5 length of saddle), 2(2b), 3(broken off), 4a(2b), 4b–d(broken off), 4e(1, about 0.3 of saddle length).

Types

USNM No. 61,420 (holotype, allotype, paratypes). Paratypes to be deposited in BMNH, CU, and CSIR (Canberra); also in coll. JNB.

HOLOTYPE FLP(713–15) and ALLOTYPE MLP(713–12), *Guadalcanal:* West Poha swamp, Nov. 3, 1944 (M. Cohen, L. J. Lipovsky *et al.*).

PARATYPES (9M; 10F; 11P; 82L; one individual rearing), all collected on *Guadalcanal* as follows: 2L(455) Sally Creek, Doma Cove, June 14, 1944 (JNB); 2M, 1F, 22L, 1P(676–3) West Poha swamp, Oct. 16, 1944 (JNB, J. Laffoon); 5M, 5F, 41L, 9P(708–3) West Poha swamp, Nov. 1, 1944 (JNB); 1MLP(713–16) same data as holotype and allotype; 5L(816–3) West Poha swamp, Jan. 12, 1945 (M. Cohen, F. B. Wysocki); 1M, 1F, 1L(837–3) West Poha swamp, Jan. 20, 1945 (J. J. Cuccio, F. B. Wysocki); 1M, 9L(958–2) West Poha swamp, Apr. 28, 1945 (J. J. Cuccio, E. J. McCormick, V. R. Roa); 2F, 1L(K-962) Dec. 27, 1943 (K. L. Knight).

Uranotaenia sexaueri is named in honor of

Henry F. Sexauer, who, in addition to his duties in operating a parasitological laboratory, found time to contribute to the mosquito survey of Guadalcanal.

Variation

Among the small number of adult specimens available there is no marked departure from the holotype and allotype except for the extremely variable light-scaling of the fore and mid tarsi and less extensive variation in the coloration of the pleural and lateral scutal integument.

The variation in the chaetotaxy of immature stages is summarized in Tables 1 and 2. The range of variation in branching of the hairs of the larva is considerable but less than in *U. solomonis*. In the pupa the branching shows much less variation.

The six adults from Bougainville show no striking differences from the Guadalcanal material. The Bougainville larvae also fall within the same range of variation.

Specimens examined: 12M; 15F; 13P; 87L. Individual rearings: 3 larval.

Taxonomic Discussion

Uranotaenia sexaueri is closely related to *U. nivipes* (Theobald, 1905) described from Queensland. A similar form, *U. albofasciata* Taylor, 1920, was described from Northern Territory, Australia, and has been synonymized with *U. nivipes* by Edwards (1924: 357). Neither original description mentioned the fact that the integument is broadly whitish on the lower part of the scutum and upper part of the pleuron and that this band is continued over the anterior margin of the scutum but Edwards (*loc. cit.*), in comparing a paratype of Taylor's species with the holotype of *U. nivipes*, noted the presence of this characteristic ornamentation in both forms. *U. sexaueri* agrees in this character but is distinguished by the extent of the white-scaling of the hind tarsus, about one half of segment 3 being white whereas only the apex is white in *U. nivipes*, and the entire segment is white in *U. albofasciata*. A further difference may be the presence of many dark scales in the lower half of the *stp* of *U. sexaueri*, a character not mentioned in the other two forms. *U. albofasciata* is distinguished from *U. nivipes* and *U. sexaueri* in having the scutellar integument light instead of dark. I have seen a single female (New Guinea, APO 565, Jul. 5, 1944, E. S. Ross No. 40) which may represent another species in the *nivipes*-group. It differs from *U. sexaueri* in having the upper part of the pleural integument not distinctly white and the lower part of *stp* with a few scattered white scales only.

The immature stages of both *U. nivipes* and *U. albofasciata* have not been described to date.

Related to the above-mentioned Australasian forms are the Oriental *U. nivea* Leicester, 1908, from Malaya and *U. triangulata* (Ludlow, 1908) from the Philippines. Edwards (1922: 460) synonymized these forms with *U. nivipes* but later (1932: 99) considered them both as representing a single variety of *U. nivipes*. Bohart (1945: 36) recognized *U. nivea* as a distinct species, retaining *U. triangulata* as a synonym. Whether or not these two forms are distinct from each other cannot be determined here, but they differ from the Australasian forms in having the scutal integument uniformly dark (without the whitish lateral area), the pleura not distinctly whitish dorsally, and the sternopleural scales light in the center and dark above and below. *U. sexaueri* agrees with *U. nivea* and *U. triangulata* in the possession of numerous dark scales on the lower part of the sternopleuron, but apparently these scales are less numerous.

Thus it appears that all the above-mentioned forms are members of a complex, the *nivipes*-group, occurring in the Oriental and Australasian regions. *U. orientalis* Barraud, 1926, from Assam, may be related to this group, but it has an entirely dark hind tarsus, and the head scaling is darker. *U. sexaueri* shows similarities to both the Oriental and the Australian forms but appears distinct from any of the species previously described.

No attempts have been made in the past to determine the relationship of the *nivipes*-group to other species groups. The ornamentation of the adults is so characteristic and distinctive that it isolates the group. It is interesting to note that the development of broad scales on *ppn* is restricted to just two species outside of this group, *U. nivipleura* Leicester, 1908, and *U. hebes* Barraud, 1931, whereas *U. unguiculata* Edwards, 1913, has lanceolate scales. These three species appear entirely unrelated and distinct from the *nivipes*-group. The male genitalia of the *nivipes*-group have the mesosome similar to that of all the other ornamented species found in the Solomons except *U. solomonis* and the ninth tergite much like that of *U. wysockii*, the *tibialis*-group, and *U. atra*. The larva of *U. sexaueri*, on the other hand, is most closely related to that of *U. civinskii*.

Biology

The immature stages of *U. sexaueri* have been collected on Guadalcanal only in dense jungle swamps in association with *U. barnesi* and *U. solomonis*. This species appears to be rare in the Solomons.

Living larvae are easily confused with *U. solomonis* but with some care can be distinguished by the lighter pigmentation of the head capsule and antenna and the considerably longer siphon. The pupae are quite distinctive as they have a moderately long trumpet (index about 3.5) that is dark in the basal half and golden brown apically.

We had little success rearing this species in the laboratory, although *U. barnesi* and *U. solomonis* larvae collected at the same time came through readily.

The adults of this species were not collected on Guadalcanal, and no information is available on their habits.

Distribution

SOLOMON ISLANDS, *Guadalcanal:* North and northwest coast (JNB *et al.;* K. L. Knight) [USNM, JNB]. *Bougainville:* Empress Augusta Bay, 2M, 3F(G-103A); 1F, 3L(G-388) (A. B. Gurney) [USNM].

6. *Uranotaenia wysockii* Belkin n. sp.
Plates 11, 12

Diagnosis

ADULT.—Head dark-scaled centrally; moderate white orbital line; a few dark erect vertical scales; conspicuous white frontal tuft. Scutal integument entirely dark; narrow line of white scales on lower margin from wing root to wing root around front; *apn* and *stp* each with narrow line of white scales forming streak in line with white-scaling of head. Tarsi light on all legs from basal third of segment 3, pure white on III, cream-colored on I and II; conspicuous white knee spots on all femora. Wing with conspicuous black and white pattern. Abdominal tergites 1–4 largely white-scaled, 5 white-scaled on apical third, 6 and 7 with narrow median apical transverse white bands. *Male* legs without conspicuous modifications.

PUPA.—Trumpet length 6.5 median width; tracheoid extending to 0.5; uniformly lightly pigmented; no slit in meatus. Hairs 4, 5-C usually 3, 4b; 3-II 2, 3b, close to 2-II; 1-III usually 3b; 4-IV–VI usually 3b, extending to middle of second segment following; 6-I–V usually single (1–2). Paddle almost as wide as long, hair absent.

LARVA.—Head approximately as wide as long; hairs weakly pigmented, no spikes; 1-A placed near middle, 3b, almost as long as antenna; 14-C dendritic. Thorax and abdomen with slender dorsal and ventral stellate hairs, usually with four to six branches of uneven lengths; some very elongate strong single hairs on thorax. Thoracic hairs 9-M, T, 8-M, and 7-T multiple, barbed; 4-P 2b; 7-P 2–4b; 9-P 2, 3b, uneven; 14-P single. Abdominal hairs 6-III–VIII stellate, much shorter than 6-I–II, without tubercles; 1-I, II usually 4b, uneven; 6-I, II usually 2b, uneven; 6-III, IV usually 4–5b. Comb plates separate; scales fringed. Siphon index about 3.0; pecten ex-

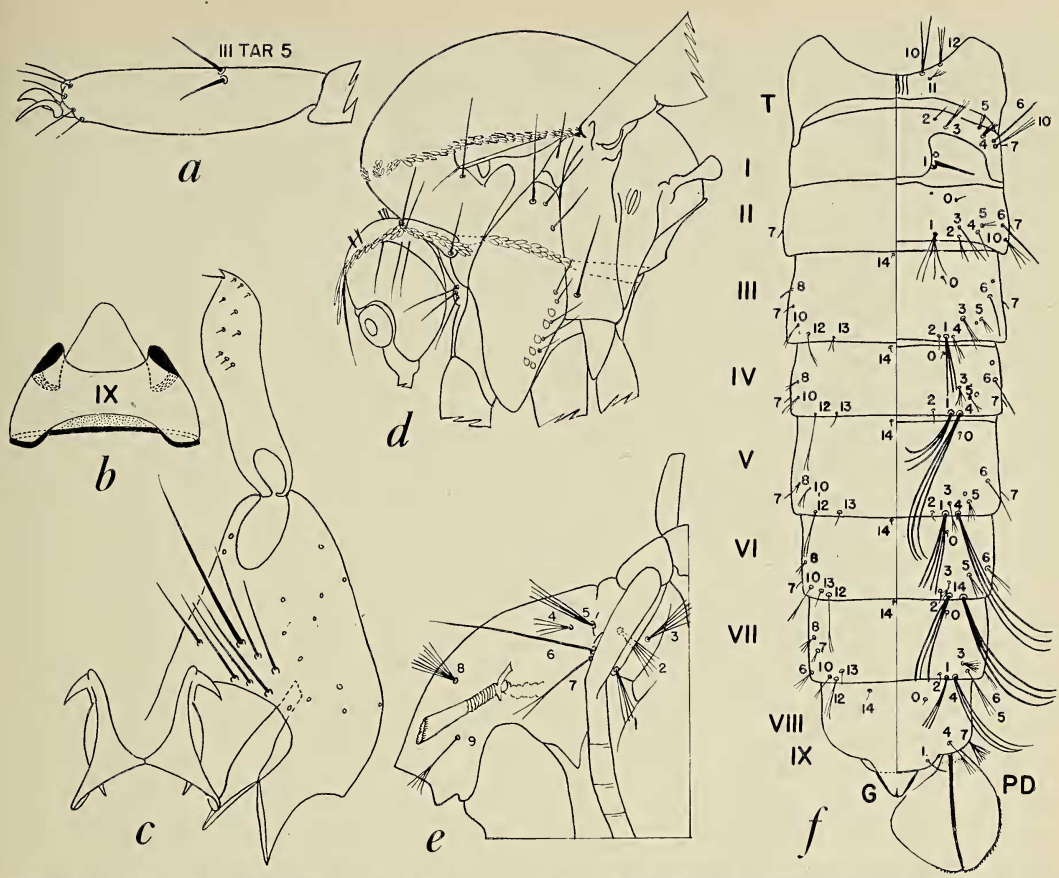

FIG. 11. *Uranotaenia wysockii* Belkin n. sp. *a–d*, Adult; *e*, *f*, pupa. *a*, Detail of metathoracic leg of male; *b*, ninth tergite of male; *c*, male genitalia; *d*, left lateral aspect of head and thorax of female; *e*, right lateral aspect of anterior portion of cephalothorax of pupa; *f*, metanotum and abdomen of male pupa, left ventral, right dorsal. Abbreviations as given on page 314.

tending to 0.8; pecten teeth apically and laterally fringed; hair 1-S longer than siphon, usually 4b; hair 9-S hook-like; hair 13-S weak, slightly twisted at base. Anal segment moderate; saddle margin with long apical spines; gills 1.6 of saddle length; hairs 1-X 2b; 2-X 3–5b; 3-X 2, 3b; 4a-X 2b.

Description

FEMALE (932–103).—Wing: 1.70 mm. Abdomen: 1.20 mm. Proboscis: 1.10 mm. Front femur: 1.37 mm.

Head: Conspicuous frontal tuft of very long, narrow, white scales, with shorter scales at base and a few broad dark scales; orbital line of white scales moderately broad, angled laterally to *apn* and slightly enlarged, scales broad and dense; decumbent dark scales iridescent bronzy; one pair of erect, slender, apically-forked, dark vertical scales; three pairs of slightly shorter similar erect occipital scales; inner occipital bristle absent, outer two outside of occipital light line. Clypeus dark brown. Palpus about 0.05 of proboscis; with small dark scales and numerous long hairs. Proboscis slightly swollen apically; dark-scaled, lighter ventrally; hairs short and inconspicuous on shaft, more numerous apically; labella lighter, moderately hairy. Antenna about 1.2 of proboscis; torus brown, without hairs; first flagellar segment creamy, remaining segments dark brown; flagellar whorls with six bristles; three apical segments subequal.

Thorax: Scutal integument rather uniformly brown; moderately dense vestiture of recumbent narrow elongate golden-brown scales, becoming broader and denser in prescutellar space; line of white scales extending from wing root to wing root around the lower margin in front as figured, integument brown; white scales in patch on anterior acrostichal area small and narrow; white scales in lateral portion of line small and narrow at anterior end becoming longer and broader posteriorly, not forming a distinct tuft in front of wing root; acrostichal bristles moderate, dorsocentrals very strong, others strong, all dark. Scutellum dark brown; median lobe moderate, with two strong bristles, scales small, golden brown, projecting slightly over base of bristles; lateral lobe with two strong bristles, scales elongate, projecting strongly over base of bristles. Pleural integument uniformly dark brown except for light iridescent areas in line with white-scaling; scaling and chaetotaxy as figured; scales white; median patches on *apn* and *stp* in line with white-scaling of head; scales of *apn* broad anteriorly, more elongate posteriorly and forming a small projecting tuft; scales of transverse patch of *stp* in two or three rows, individual scales oval, decumbent; scales of lower sternopleuron scattered, translucent dark, broadly oval; bristles dark, propleurals strong, spiracular and upper mesepimerals absent. Haltere light on base and stem, knob cream-scaled basally, dark-scaled on extreme apex.

Wing: Distance between crossveins about 1.3 of *m-cu*. Vein R_2 about 0.33 of R_{2+3}; vein M_{1+2} about 0.6 of M beyond *m-cu*. Conspicuous black and white pattern of scaling on dorsal and ventral surfaces: anterior border dark, median and posterior part white, with indistinct gray subapical transverse band, apex of wing white beyond base of anterior fork cell (R_2); vein C dark except on caudal margin at base and at apex beyond level of cell R_2; vein Sc dark-scaled ventrally; vein R white at base to 0.24 of wing length; veins R_S and R_{2+3} dark-scaled below and above; vein R_{4+5} dark-scaled above at extreme base, then for one third its length starting at 0.17, white-scaled for remainder of dorsal surface and entire ventral surface; vein M dark-scaled ventrally from *m-cu* distad; veins M_{1+2} and M_3 dark-scaled at base dorsally; vein Cu_1 dark-scaled for its apical 0.65, Cu_2 for its entire length; remaining portions of all veins white-scaled. Fringe white, creamy at apex.

Legs: Coxae and trochanters brown to light brown; scales translucent except proximally on coxae I and II where they are white. Femora dark above, cream-colored below; prominent dorsal knee spots of pure white scales. Tibiae dark-scaled, cream-colored apically. First two segments of tarsi dark-scaled, lighter below; basal third of segment 3 dark above; remainder of segment 3 and all of segments 4 and 5 white-scaled, pure white on tarsus III, cream-white on I and II. Leg I: femur 1; tibia 1.0; tarsus 0.80, 0.45, 0.30, 0.15, 0.10. Leg II: femur 1.06; tibia 1.40; tarsus 0.88, 0.42, 0.30, 0.12, 0.05. Leg III: femur 1.10; tibia 1.20; tarsus 0.98, 0.60, 0.47, 0.25, 0.06.

Abdomen: Tergite 1 white-scaled except for cream-colored patch laterally; tergites 2–4 with large median patch of white scales extending from base to apex, wider apically; tergite 5 with white-scaled patch occupying apical two thirds; tergites 6 and 7 with median apical transverse band of white scales; remainder dark-scaled. Sternites dark-scaled.

MALE (932–102).—Wing: 1.54 mm. Proboscis: 1.05 mm. Front femur: 1.33 mm.

Generally very similar to female. Proboscis more distinctly swollen apically. Orbital line of white scales much narrower than in female. Flagellar whorls about 0.4 of flagellum, with about 26 bristles; penultimate segment about 1.65 of preceding, apical about 1.10 of penultimate. Leg I: femur 1; tibia 1.0; tarsus 0.75, 0.45, 0.27, 0.13, 0.07; claws equal, one broadened, other slender. Leg II: femur 1.05; tibia 1.41; tarsus 0.88, 0.46, 0.26, 0.12, 0.08, segment 4 with median ventral lobe projecting below 5, segment 5 with dorsoapical lateral lobes; claws enlarged, smaller claw 0.65 of

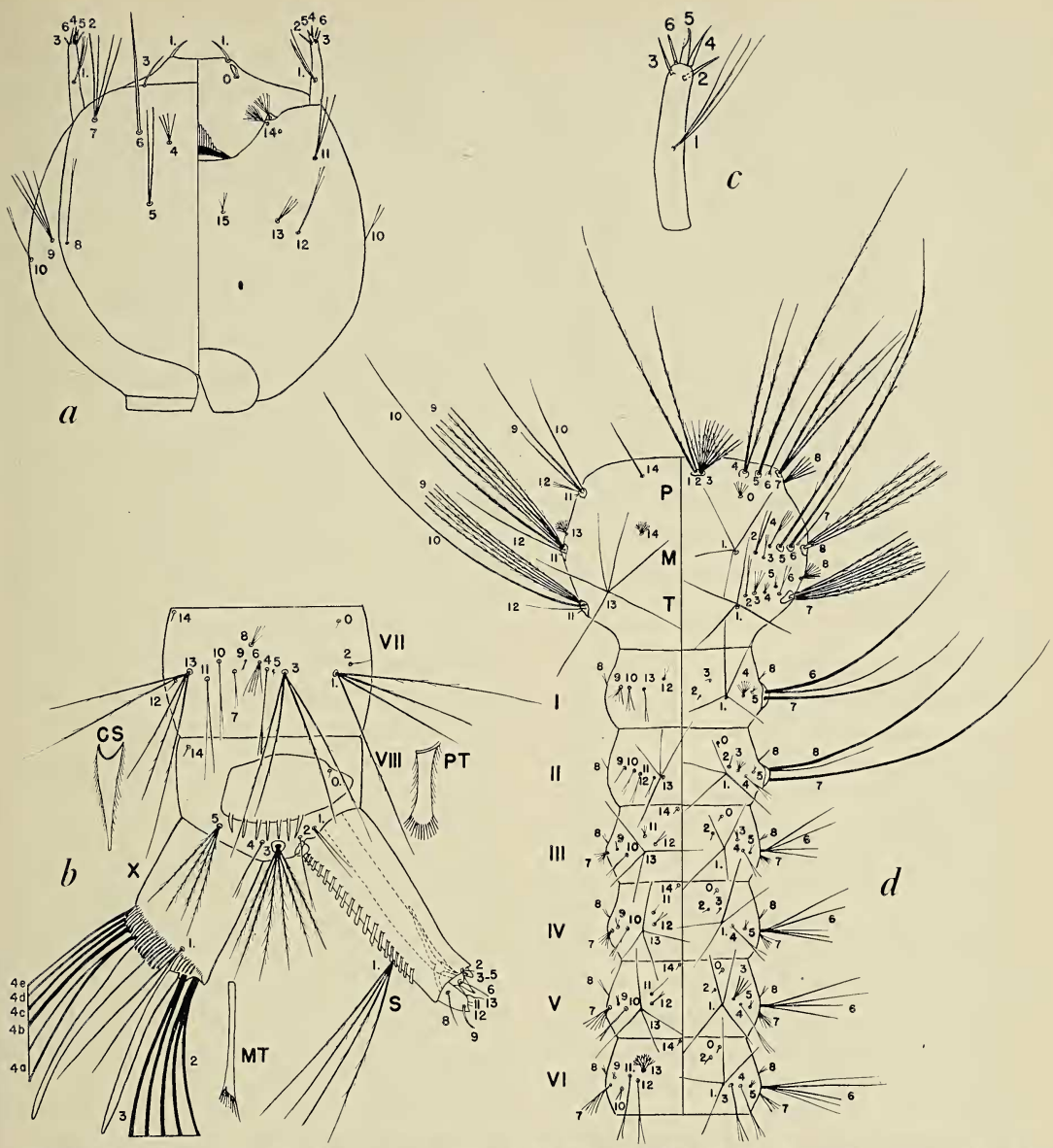

FIG. 12. *Uranotaenia wysockii* Belkin n. sp. Fourth instar larva. *a*, Head, left dorsal, right ventral; *b*, left lateral aspect of distal abdominal segments; *c*, dorsal aspect of left antenna; *d*, thorax and proximal abdominal segments, left ventral, right dorsal. Abbreviations as given on page 314.

larger. Leg III: femur 1.05; tibia 1.20; tarsus 0.98, 0.62, 0.50, 0.26, 0.10; claws as on foreleg and as figured. All leg segments paler than in female.

MALE GENITALIA (932–102).—Ninth tergite long; proximal part shallowly emarginate; apex shallowly emarginate; lateral lobe moderately projecting, with ventrolateral sclerotization. Proctiger with slight lateral sclerotizations. Basal lobe of sidepiece with a dorsal group of one large and four smaller bristles and several minute hairs; a ventral group of several small bristles. Clasper as figured. Mesosome with narrow basal dorsal sclerotized bridge only; apical tooth more slender than in diagram; median tooth long, directed ba-

sad, only slightly curved mesally. Paramere slightly expanded near base.

PUPA (Exuviae of holotype, 932–103).—Abdomen: 1.70 mm. Trumpet: 0.25 mm. Paddle: 0.32 mm.

Cephalothorax: Uniformly lightly pigmented except for darker mesonotum and base of wing pads. Trumpet lightly and uniformly pigmented; length 6.50 median width; gradually widened beyond middle to apex; inner wall separated from base to apex; tracheoid extending about 0.5; reticulations indistinct; pinna about 0.2; no slit in meatus. All hairs lightly pigmented and simple; relative position, length, and degree of development as figured; base of branched hairs, except 8-C, without flattened, expanded plate. Hairs: 1(4b), 2(4, 6b), 3(5, 7b), 4(4, 5b), 5(4b), 6(1), 7(2, 3f), 8(9b), 9(2, 3f), 10(2, 3b), 11(4f), 12(2f).

Abdomen: Basal segments unevenly pigmented, with submedian pale areas, connected on I; posterior segments uniformly more lightly pigmented; tergites II–VII with small posteromedian patch of indistinct minute spicules; tergite VIII with anteromedian patch of imbricate lines of minute spicules; tergal reticulations not visible; sternites III–VIII with extensive median patch of extremely minute and indistinct spicules. All hairs lightly pigmented; relative position, length, and degree of development as figured; bases of branched hairs, except 1-I, without flattened, expanded plate. Segment I: hair 1(21, 23 primary branches, moderate number of thin apical secondary branches; about 0.75 length of tergite), 2(1), 3(3, 4b), 4(3, 5b), 5(3b), 6(1, 2b), 7(1, 3f), 10(2, 3b). Segment II: hair 0(1), 1(5b), 2(2bf), 3(2f), 4(1), 5(2b), 6(1), 7(1), 10(3b). Segment III: hair 0(1), 1(3b), 2(1), 3(3b), 4(3b), 5(3b), 6(1), 7(1), 8(2b), 10(2f), 12(2f), 13(1), 14(not seen). Segment IV: hair 0(1), 1(3, 4b), 2(1), 3(3b, twice length shown on figure), 4(3b), 5(2f), 6(1), 7(1), 8(3, 4b), 10(3b), 12(2f), 13(1), 14(not seen). Segment V: hair 0(1), 1(3b), 2(1), 3(3, 4f), 4(3b), 5(2, 3bf), 6(2f), 7(1), 8(1, 2f), 10(2b), 12(2f), 13(1), 14 (not seen). Segment VI: hair 0(1), 1(3b), 2(1), 3(3, 4f), 4(3b), 5(2, 3f), 6(2b), 7(1), 8(1, 2f), 10(2f), 12(2f), 13(1), 14(not seen). Segment VII: hair 0(1), 1(3, 4b), 2(1), 3(5, 6b), 4(3b), 5(3b), 6(3b), 7(0, 3b), 8(1, 2b), 10(2f), 12(3b), 13(1), 14(0, 1). Segment VIII: caudal margin of sternite strongly and evenly emarginate; hair 0(1), 4(3bf), 7(5, 7b), 14(1). Segment IX: hair 1(1, very thin, slightly longer than segment). Paddle as figured; very lightly pigmented; midrib strongly sclerotized and darkly pigmented; external buttress poorly defined; external margin with minute teeth; apex of inner margin with a few lighter teeth; hair 1 absent. Genital lobe extending to about 0.27 of paddle; patch of strong spicules ventrally. Anal segment with dorsolateral expansion, no indication of cercal sclerite. Male genital lobe (exuviae of allotype, 932–102) extending to 0.4 of paddle, pair of small ventral apicolateral patches of weak spicules; anal segment extending 0.5 from apex of IX to apex of genital lobe, 0.5 width of latter.

LARVA (Fourth instar exuviae of holotype, 932–103).—Head: 0.60 mm. Siphon: 0.36 mm. Anal saddle: 0.26 mm.

Head: Approximately as long as wide; ocular bulge near middle, not well defined; very lightly pigmented, darker dorsocaudad on midline; integumentary imbricate sculpturing distinct caudally only. Labrum long, 0.35 of width at 1-C, anterior margin very shallowly emarginate. Mental plate with 17 blunt teeth, conspicuously defined basally on plate. Hairs of head capsule all very lightly pigmented, inconspicuous; slender except for 6-C which is somewhat flattened basally; barbs absent except minute ones on base of 6-C; relative position, length, and degree of development as figured. Hair 0(broken off), 1(1, curved, sharply pointed), 3(1, simple, thin, flattened in basal half, sharply pointed, reaching to base of 1-C), 4(4, 5b), 5(2, 3b), 6(1), 7(4, 5b), 8(2f), 9(3, 4b), 10(2f), 11(3, 4b), 12(2f), 13(3, 4b), 14(small flattened tuft of 12, 14 branches), 15(3b). Antenna about 0.2 of head, slightly curved, almost parallel-sided, with slight

swelling near base; width approximately 0.2 of length; very lightly and uniformly pigmented; shaft smooth, without spicules. Antennal hairs all lightly pigmented and inconspicuous; relative position, length, and degree of development as figured; all single except 1-A which is 3-branched and almost as long as antenna.

Thorax: All hairs and tubercles very lightly pigmented, slightly darker than head integument and hairs; relative position, length, and degree of development of hairs as figured; apices of long hairs attenuated and very elongate; barbs when present very slender and sparse; hair 5-P about 2.0 of head length. Prothorax: hair 0(3, 4b, all primary), 1(broken off), 2(1), 3(13, 14b, with broad fan-like asymmetrical base), 4(2b), 5(1), 6(1), 7(2, 3b, third branch smaller), 8(4, 5b), 9(2b, one branch very small), 10(1), 11(2f), 12(3, 4f), 14(1, 2f, slightly thickened, with minute barbs). Mesothorax: hair 1(4b), 2(2, 3b), 3(1, 2f), 4(4f), 5(broken off), 6(broken off), 7(1), 8(4b), 9(5b), 10(1), 11(1), 12(1), 13(moderately dendritic tuft of 15–17 branches), 14 (moderately dendritic tuft of 18–19 branches). Metathorax: hair 1(3b), 2(2f), 3(3b), 4(2f), 5(2b), 6(2f), 7(6b), 8(8, 9b, all primary), 9(5b), 10(1), 11(1), 12(1), 13(5b).

Abdomen: Hairs and tubercles of segments I, II lightly pigmented as on thorax; hairs of following segments considerably darker, particularly stellate tufts; relative position, length, and degree of development as figured; barbs when present very slender, short and inconspicuous. Stellate hairs (1, 6, 13) with branches of two lengths; 4-II a forked hair, not stellate. Segment I: hair 1(3b), 2(1), 3(1, 2f), 4(7, 9b), 5(2, 3b), 6(2b), 7(1), 8(2b), 9(5, 6b), 10(4b), 12(1), 13(2, 3f). Segment II: hair 0(1), 1(3b), 2(1), 3(3, 4b), 4(2, 3f), 5(3b), 6(broken off), 7(1), 8(1), 9(1), 10(2f), 11(2f), 12(2f), 13(4b). Segment III: hair 0(1), 1(3b), 2(1), 3(3f), 4(2f), 5(2b), 6(3b), 7(6, 7b), 8(2b), 9(1, 2f), 10(2f), 11(2, 3f), 12(2b), 13(3, 4b), 14(1). Segment IV: hair 0(1), 1(2, 3b), 2(1), 3(1), 4(2, 3f), 5(3, 4b), 6(4b), 7(6b), 8(2f), 9(1, 2b), 10(2, 3f), 11(1, 2b), 12(1, 2b), 13(3, 4b), 14(1). Segment V: hair 0(1), 1(3b), 2(1, 2b), 3(3b), 4(2f), 5(2, 3f), 6(4, 5b), 7(4, 5b), 8(2b), 9(2f), 10(2f), 11(1), 12(2f), 13(4b), 14(1). Segment VI: hair 0(1), 1(2b), 2(1, 2b), 3(2, 3f), 4(2, 3f), 5(3, 4b), 6(4b), 7(5b), 8(2b), 9(2b), 10(2, 3b), 11(2f), 12(2f), 13(15, 16d), 14(1). Segment VII: hair 0(1), 1(2, 3b), 2(1), 3(3, 4b), 4(1), 5(1), 6(4b), 7(2f), 8(4b), 9(4b), 10(1, 2f), 11(2b), 12(1), 13(4b), 14(1). Segment VIII: comb plate heavily sclerotized, moderately pigmented, ornamented with numerous lines of minute spicules; comb scales 8–8, uniform in size, with inconspicuous fine lateral fringes as figured; hair 0(1), 1(2f), 2(2, 3f), 3(4, 6b, conspicuously barbed), 4(2f), 5(4b, conspicuously barbed), 14(2f). Siphon: as figured; length 3.0 median width; moderately pigmented, ornamented with numerous lines of minute spicules; pecten extending to 0.8, teeth 21–20 with lateral and apical fringe as figured; valves as figured; hair 1(4b, two long, two short, lightly barbed, slightly longer than siphon), 2(1, slender), 3, 4(minute), 6(1, longer than valve), 7(not seen), 8(1, weaker than 6, as long as valve), 9(strong, hook-like), 10–12 (not seen), 13(1, weak, twisted bristle). Segment X: saddle uniformly and lightly pigmented, ornamented with numerous lines of minute spicules; median width 0.65 of length; caudal margin with several rows of long, apically fringed spines as in figure; gills 1.6 length of saddle, narrow, blunt apically; hair 1(2b, about 1.2 length of saddle, uneven), 2(3b, about 4.0 length of saddle), 3(broken off), 4a(2b, about 4.2 length of saddle), 4b (2b, about 4.0 length of saddle), 4c(1, about 3.8 length of saddle), 4d(1, about 3.8 length of saddle), 4e(1, about 2.8 length of saddle).

Types

USNM No. 61,421 (holotype, allotype, paratypes). Paratypes to be deposited in BMNH, CU, and CSIR (Canberra); also in coll. JNB.

HOLOTYPE FLP(932–103) and ALLOTYPE MLP(932–102), *Guadalcanal:* Tenaru, Mar. 28, 1945 (JNB, M. Cohen, E. Winkler).

PARATYPES (1M; 7F; 7P; 11L; 6 individual rearings) all collected on *Guadalcanal*, as follows: 3L(920–4) Tenaru, Mar. 15, 1945 (JNB, M. Cohen); 1FP(932–101) same data as holotype and allotype; 1MLP(941–32), 4FLP (941–31, 33, 34, 35) Kokumbona trail, 8 miles from north coast, April 8, 1945 (JNB); 1F, 1P(0–38) Tenaru, Sept. 28, 1943 (P. W. Oman); 1F, 3L, Tenaru, Oct. 1944 (J. G. Franclemont).

Uranotaenia wysockii is named in honor of F. B. Wysocki in recognition of the many valuable collections he made on Guadalcanal.

Variation

The small series of adults from Guadalcanal, although reared from larvae collected in two widely separated localities in different plants, show no striking variations. The white-scaling of the abdomen is quite variable, and there is often a small basal median triangular spot on segments 2 to 4 encroaching upon the white markings. The head, thorax, and legs show very little variation in coloration.

The variation in the chaetotaxy of immature stages is shown in Tables 1 and 2. Again there are no constant differences correlated with the different origin of the specimens. Individuals vary considerably in the branching of the hairs but within the same range as the other species of *Uranotaenia*. The following larval hairs are unusually variable in branching: 4-C, 1-A, 0-P, 3-VIII, 2-X. There is more variation in the number of pecten teeth than in any other species studied. The pupal stage is about as uniform as in the other species.

The material from Bougainville falls within the range of variation exhibited by the specimens from Guadalcanal without any special features or concentration at one or other extreme.

Specimens examined: 9M; 25F; 9P; 22L. Individual rearings: 7 larval, 1 pupal.

Taxonomic Discussion

Uranotaenia wysockii is a very distinct and isolated species in the *alboannulata*-group. This group has not been reported previously from the Australasian region. The Oriental species, *U. alboannulata* (Theobald, 1905) from South India, *U. rutherfordi* Edwards, 1922, from Ceylon, and *U. trilineata* Leicester, 1908, from Malaya are highly ornamented with light spots, lines, or bands on the proboscis (not in *U. rutherfordi*) and on the femora, tibiae, and hind tarsus. *U. wysockii* agrees with these species in having pictured wings, a narrow light-scaled line from wing root around the front margin of the scutum, and the narrow light-scaled line across *stp* and *apn* connecting with the narrow orbital light-scaled line on the head. It differs from the Oriental species in the following combination of characters: proboscis dark-scaled; all femora with an apical white knee spot only; all tibiae dark; hind tarsus white-scaled from basal third of segment 3; fore and mid tarsi cream-colored from basal third of segment 3.

The immature stages of the Oriental species are not known. It is likely that they will be found in water collections in living plants.

It is possible that *U. nivipleura* Leicester, 1908, from Malaya is related to this group as it has the characteristic mesonotal scale border and has been bred from pitcher plants. It is distinct from the *alboannulata*-group in having dark wings and dark legs. The record of *U. nivipleura* by Barraud (1934: 76–77) from the Western Himalayas does not seem correct to me, nor Bohart and Ingram's (1946: 57) record from Okinawa.

It is quite likely that members of the *alboannulata*-group have been collected in the Australasian region and in the Philippines but have been misidentified as members of the *nivipes*-group. Both groups have the wing patterned in black and white, and the descriptions of the species of the *nivipes*-group are very misleading as to the nature of the light area around the lateral margin and front of the scutum.

Biology

Uranotaenia wysockii is known from reared specimens only. On Guadalcanal larvae were collected in the water-holding leaf axils of a short heavy-stemmed, prostrate, stoloniferous pandanus with broad, almost smooth-margined leaves (*Freycinetia* sp.?) growing in a densely shaded nipa-palm swamp (coll. 920, 932), some 3 miles from the coast. Associated with it were an undescribed *Culex* (*Lophoceraomyia*), *Aedes* sp. (*kochi*-group), and an undescribed *Corethrella*. The other collection came from an elevation of over 3,000 feet, about 8 miles from the coast, and was made in leaf axils of a large, erect pandanus with broad, smooth-margined leaves growing in the open. Associated with *U. wysockii* in this habitat were two species of the *Aedes kochi*-group and *Culex* (*Lophoceraomyia*) sp.

Superficially, the larvae of *U. wysockii* bear little resemblance to those of ground-water species. The broad head is much like that of other inhabitants of water collections in plants, and the simple hairs on the thorax and anterior portion of the abdomen, as well as those on the caudal segments, are greatly elongate. The short, characteristically shaped siphon with its very long tuft is also very different from typical *Uranotaenia*. The presence of a comb plate and a long siphonal tuft will separate the larva from all plant breeders on Guadalcanal. The larvae spend most of the time feeding at the bottom, unlike ground pool breeders. The pupae are of the typical *Uranotaenia* type and like the larvae are very lightly pigmented. The short, slender, uniformly pigmented and widely spaced trumpets are very characteristic and separate this species from all other mosquitoes found in similar habitats.

On New Georgia and Bougainville, *U. wysockii* has been reported as breeding in the leaf axils of lily-like and aroid plants. I suspect that the plants were smooth-leaved pandanus (*Pandanus* sp. or *Freycinetia* sp.) as on Guadalcanal.

Distribution

SOLOMON ISLANDS, *Guadalcanal:* Tenaru and Kokumbona trail (JNB, J. G. Franclemont, P. W. Oman) [USNM, JNB]. *Bougainville:* Empress Augusta Bay, 1M, 4F, Mar. 4, 1944 (C. R. Bruck); 1M(G-104A) July 1, 1944; 1F(G-270) Mar. 6, 1944; 1F(G-341); 1F(G-344) Apr. 24, 1944; 1L(G-356–2), 1F (G-357) Apr. 27, 1944; 6L(G-364) May 3, 1944; 1L(G-383) May 17, 1944; 5M, 5F(G-421) June 27, 1944; 4F(G-431) July 1, 1944 (A. B. Gurney) [USNM, JNB].

7. **Uranotaenia quadrimaculata** Edwards *in* Paine and Edwards, 1929

Plates 13, 14

1929. *Uranotaenia quadrimaculata* Edwards *in* Paine and Edwards, Bul. Ent. Res. 20: 315–6. *Types:* M, F, L, P; *Guadalcanal:* Rere, 19 Aug. 1928; 11u, 26 Aug. 1928. *Malaupaina* (near San Cristobal): 4 Sept. 1928 (R. W. Paine) [BMNH (Paine and Edwards, 1929)].

1926. *Uranotaenia nigerrima* Taylor. Edwards, Bul. Ent. Res. 17: 109 (misident.).

1944. *Uranotaenia nigerrima* Taylor. Knight, Bohart, and Bohart, Keys Mosq. Australasian Reg. p. 15, 68 (*partim*, misident.).

1944. *Uranotaenia quadrimaculata* Edwards. Knight, Bohart, and Bohart, Keys Mosq. Australasian Reg. p. 15, 69 (*partim*, misident.).

Diagnosis

ADULT.—Head densely covered with long, dark, erect, vertical scales; decumbent scales very light purplish-brown. A large velvety black spot on each side of scutum in front of wing root and another on *ppn*, contrasting sharply with rest of integument. Scutal vestiture of elongate curved decumbent purplish-brown scales; lighter scales in streak above and behind dark scutal spot; a few curved, light scales on scutum above anterior end of *ppn*. Pleura light; broad translucent light

scales on *apn* only. Legs entirely dark. Wings completely dark-scaled. Abdominal tergites entirely dark purplish-brown. *Male* legs without conspicuous specializations.

PUPA.—Trumpet length 3.0 or less of median width; tracheoid restricted to basal 0.25 or less; uniformly brilliant brown; no slit in meatus. Cephalothoracic hairs, except 8-C, single or 2–3b; abdominal hairs, except 1-I, single or 2–3b(rarely 4, 5b); hair 8-II present. Paddle with distinct serrations on external and internal margins; hairs 1 and 2 both present, strong.

LARVA.—Head longer than wide; hairs weakly pigmented, no spikes; 1-A placed at 0.7–0.8 of antenna. Thorax and abdomen without dorsal or ventral stellate hairs, most hairs single or 2–4b. Thoracic hairs 9-P, M single; 8-M, 7-T short, multiple, not barbed. Abdominal hairs 6-I–IV of approximately equal size, all with tubercles. Comb plates united dorsally into saddle; scales not fringed. Siphon index 2.0 or less; pecten teeth not fringed but sometimes with basal denticles; hair 1 very short, inconspicuous; hairs 7, 8-S usually 2b; hair 13-S simple. Anal segment very short; gills 3.0 length of saddle; saddle margin without projecting apical spines; hairs 1-X 1–3b; 2, 3-X 1, 2b; 4a–d-X single.

Description

FEMALE (523–23).—Wing: 2.66 mm. Abdomen: 1.66 mm. Proboscis: 1.50 mm. Front femur: 1.83 mm.

Head: Numerous elongate dark erect vertical scales, stem very slender, apex expanded, 3- or 4-pronged; no frontal tuft; recumbent scales iridescent very light purplish-brown, lighter laterally toward *apn;* orbital bristles rather evenly spaced. Clypeus light brown. Palpus about 0.09 of proboscis; purplish-brown scales apically; hairs about 0.5 of shaft length. Proboscis distinctly swollen apically; dark-scaled dorsally, lighter ventrally, especially on swollen part; numerous short hairs apically; labella light, densely hairy. Antenna about 1.33 of proboscis; torus light brown, darker mesally and dorsally, with short hairs mesally; base of first flagellar segment cream-colored, remainder of flagellum very dark brown; first flagellar segment 1.2 of second; three apical segments subequal.

Thorax: Conspicuous velvety black spots on posterior pronotum and on scutum in front of wing root as figured. Scutal integument uniformly light brown; dense vestiture of recumbent narrow purplish-brown scales centrally; tuft of erect lighter narrow scales at extreme anterior end among dorsocentrals and a few shorter curved recumbent light scales just external to dorsocentrals above anterior end of *ppn;* elongate patch of narrow recumbent scales over black spot in front of wing root, scales lighter than on disc, becoming whitish in caudal extension over supra-alar bristles; acrostichals short, all bristles dark. Scutellum brown; median lobe moderate, with one weak and four strong bristles; lateral lobe with four strong and two weak bristles; vestiture of broad recumbent purplish bronzy-brown scales projecting moderately over bristles of lateral lobe. Pleural integument cream-colored, darker along diagonal line from spiracle to lower mesepimeron and on *apn*, velvety black spot on *ppn*; scales absent except broad translucent whitish scales forming large patch on *apn;* large bristles dark, smaller light; propleurals four, upper mesepimerals three or four. Haltere light at base and lower part of stem, dark-scaled on upper part of stem and knob.

Wing: Distance between crossveins 0.4 of *m-cu*. Vein R_2 about 0.29 of R_{2+3}; vein M_{1+2} about 0.72 of M beyond *m-cu*. Wing scales all dark. Fringe narrow, dark.

Legs: Coxae and trochanters cream-colored; scales light and translucent, inconspicuous; coxa I with about 12 bristles on anterior face; coxa III with seven bristles on caudal face. Femora dark-scaled above, lighter below; femur II swollen basally, cream-colored ventrally, with seven conspicuous thin erect hairs dorsally in basal half and three similar hairs on external surface of apical third. Tibiae dark

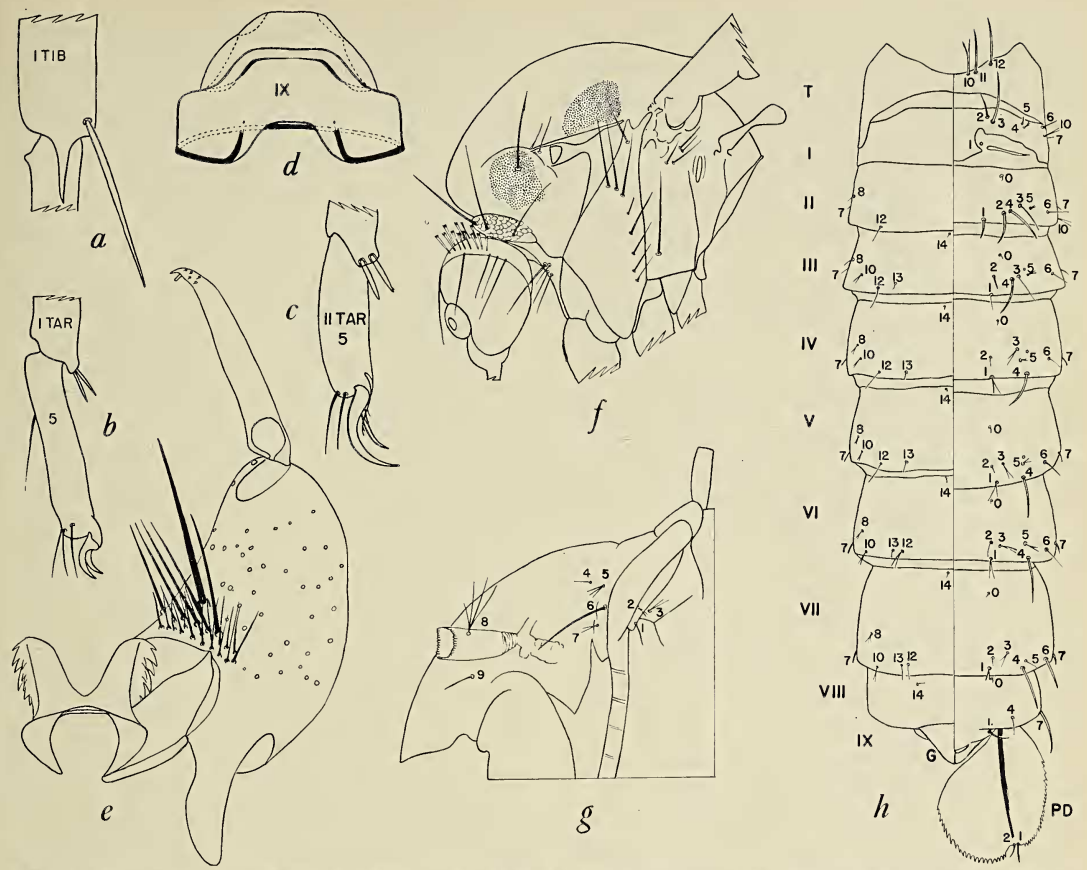

FIG. 13. *Uranotaenia quadrimaculata* Edwards, *in* Paine and Edwards, 1929. *a–f*, Adult; *g*, *h*, pupa. *a–c*, Details of pro- and mesothoracic legs of male; *d*, ninth tergite of male; *e*, male genitalia; *f*, left lateral aspect of head and thorax of female; *g*, right lateral aspect of anterior portion of cephalothorax of pupa; *h*, metanotum and abdomen of male pupa, left ventral, right dorsal. Abbreviations as given on page 314.

above, lighter ventrally. Tarsi dark above, lighter below, apical segments lighter, almost creamy on II. Leg I: femur 1; tibia 1.09; tarsus 0.87, 0.40, 0.28, 0.14, 0.06. Leg II: femur 0.95; tibia 1.22; tarsus 0.95, 0.40, 0.28, 0.13, 0.07. Leg III: femur 0.95; tibia 1.22; tarsus 1.43, 0.73, 0.60, 0.34, 0.10.

Abdomen: Tergites entirely dark iridescent purplish-brown; sternites entirely cream-colored.

MALE (939–41).—Wing: 2.30 mm. Proboscis: 1.50 mm. Front femur: 1.75 mm.

Generally very similar to female. Proboscis about the same as in female. Flagellar whorls with about 24 bristles, 0.4 of flagellar length; penultimate segment 3.0 of preceding, subequal to apical. Leg I: femur 1; tibia 1.05; tarsus 0.84, 0.37, 0.28, 0.13, 0.08; claws equal and similar. Leg II: femur 0.93; tibia 1.16; tarsus 0.87, 0.37, 0.26, 0.12, 0.07; one claw enlarged, other short. Leg III: femur 0.90; tibia 1.15; tarsus 1.40, 0.66, 0.56, 0.36, 0.11; claws equal, similar.

MALE GENITALIA (939–41).—Ninth tergite narrowly and deeply emarginate at base; basal sclerotization angled caudad before emargination and evanescent; apex truncate, not produced into lateral lobes; subapical light sclerotization extended ventrolaterad proximally as a weak bar. Proctiger with distinct ventrolateral scoop-shaped sclerotization and a more apical ventral sclerotization bearing small spicules. Basal lobe of sidepiece with one very heavy apical bristle and three rows

of progressively shorter bristles basad; one strong and several short bristles ventrally. Clasper long, slender; as figured. Mesosome with fairly broad dorsal basal bridge and with a very narrow complete ventral bridge; lateral plate with two rows of ventrolateral short teeth or serrations. Paramere very broad except distally.

PUPA (Exuviae of female, 523–23).—Abdomen: 2.70 mm. Trumpet: 0.38 mm. Paddle: 0.58.

Cephalothorax: Moderately pigmented; appendage cases, meso- and metanotum darker. Trumpet brilliant brown; length 2.8 median width; gradually widened from base to about 0.5, then almost parallel-sided; inner wall distinctly separated throughout, distinctly constricted at 0.5 and then flared out, apical portion with conspicuous elongate imbrications; tracheoid very poorly developed, restricted to basal 0.25 of anterior face; reticulate with indistinct small shallow imbrications, without spicules; pinna 0.2; no slit in meatus. Hairs moderately to strongly pigmented; relative position, length, and degree of development as figured; branched hairs with simple base, barbs absent except as noted. Hairs: 1(1, 2f), 2(2, 3b), 3(1, 2b), 4(1, 2b), 5(3b), 6(1), 7(2, 3b), 8(3, 4b), 9(1), 10(1, with conspicuous apical and subapical brush of barbs), 11(1, minutely barbed), 12(1), extra hair on left side caudad of 12, probably homolog of larval hair 4-T.

Abdomen: Strongly pigmented on proximal segments with lighter areas around bases of hairs; distal segments moderately pigmented; tergites II–VIII with imbrications more distinct on proximal segments and bearing small apical spicules which are larger toward midline and form extensive patches; tergite I with patch of small spicules on median bridge cephalad of float hairs; sternites II–VIII with entire surface ornamented with small spicules arising from faint imbrications. Large hairs very darkly pigmented, smaller moderately; relative position, length, and degree of development as figured; branched hairs with simple base, barbs absent except as noted. Segment I: hair 1(dichotomously branched, with about 10 principal branches, barbs distinct), 2(1), 3(1), 4(2b), 5(1), 6(1), 7(1), 10(2b). Segment II: hair 0(1), 1(2, 3f), 2(1), 3(1), 4(1), 5(3b), 6(1), 7(1), 8(1), 10(2b), 12(0). Segment III: hair 0(1), 1(2b), 2(1), 3(1), 4(1), 5(1, 2f), 6(1, 2b), 7(1), 8(1), 10 (2b), 11(setal ring on right side), 12(1, 2b), 13(1), 14(1). Segment IV: hair 0(1), 1(2b), 2(1), 3(2, 3b), 4(1), 5(2f), 6(2b), 7(1), 8(2f), 10(2b, f), 11(1), 12(1), 13(1) ,14(1). Segment V: hair 0(1), 1(2, 3b), 2(1), 3(2b), 4(1), 5(2, 3b), 6(1, 2f), 7(1), 8(2f), 10(2, 3b), 11(1, on right side only), 12(2b), 13(1), 14(1). Segment VI: hair 0(1), 1(2b), 2(1), 3(2, 3b), 4(1), 5(2f), 6(1), 7(1), 8(2f), 10(2b), 12(2b), 13(1), 14(1). Segment VII: hair 0(1), 1(2, 3b), 2(1), 3(2b), 4(1), 5(2f), 6(1), 7(1), 8(3b), 10(3b), 12(1, 2b), 13(1), 14(1). Segment VIII: caudal margin of sternite very shallowly emarginate; hair 0(1), 4(1), 7(1, 2b), 14(1). Segment IX: hair 1(1, about 0.7–0.9 of segment length). Paddle as figured; moderately pigmented; midrib moderately sclerotized, evanescent apically; external buttress indistinct; basal pigment bar absent; external margin with distinct serrations from basal 0.25, strong apically; internal margin with even stronger, more sharply pointed serrations from midrib apex to basal 0.5; hair 1(1, very strong, about 0.25 of paddle), 2(1, strong, about 0.3 of 1). Genital lobe extending to 0.33 of paddle, entire ventral surface with spiculate imbrications. Anal segment visible, shorter than genital lobe; cercal sclerite not defined. Male genital lobe (exuviae of 939–41) extending to 0.35 of paddle; ventral surface with faint spiculate imbrications; anal segment distinct, short, extending 0.3 from apex of IX to apex of genital lobe.

LARVA (Fourth instar exuviae of female, 523–23).—Head: 0.80 mm. Siphon: 0.52 mm. Anal saddle: 0.18 mm.

Head: Width 0.9 of length; ocular bulge not distinctly defined; pigmentation a moderate bright yellowish brown, darker brown cau-

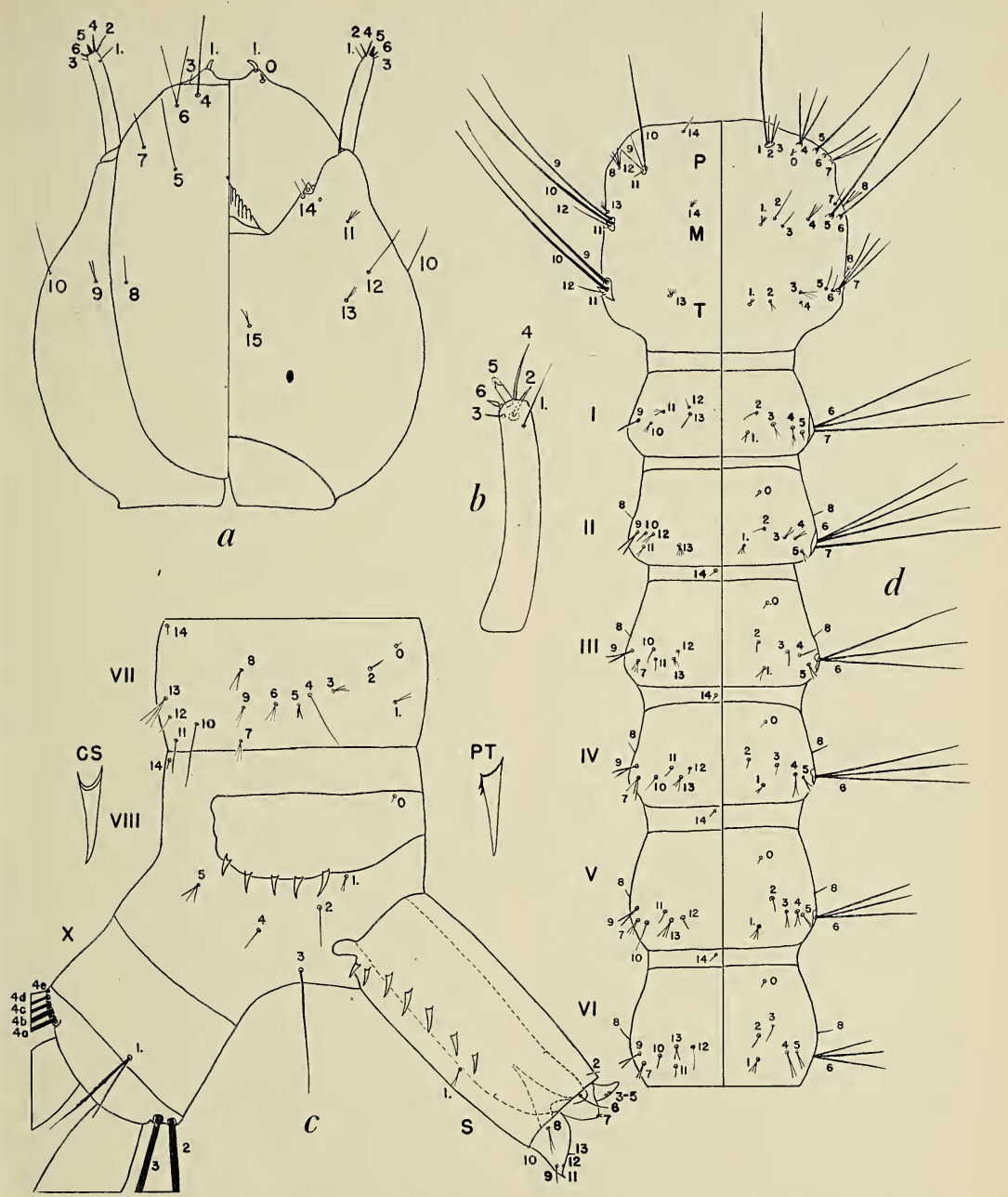

FIG. 14. *Uranotaenia quadrimaculata* Edwards, *in* Paine and Edwards, 1929. Fourth instar larva. *a*, Head, left dorsal, right ventral; *b*, dorsal aspect of left antenna; *c*, left lateral aspect of distal abdominal segments; *d*, thorax and proximal abdominal segments, left ventral, right dorsal. Abbreviations as given on page 314.

dally and middorsally; integumentary sculpturing indistinct except caudally. Labrum short, 0.25 of width at 1-C, anterior margin moderately emarginate. Mental plate large, acute; with 21 distinct teeth. Hairs of head capsule weakly pigmented except for 4, 6-C, all inconspicuous; 5, 6-C slender, not spike-like; relative position, length, and degree of development as figured. Hair 0(1, short, leaf-like), 1(1, very short, stubby, bluntly pointed), 3(1, very short, inconspicuous), 4(1, darkly pigmented), 5(1), 6(2, 3b), 7(1), 8(1), 9(3b), 10(1), 11(2b), 12(1), 13(2b), 14(1, slender, simple), 15(1). Antenna 0.25 of head; uniform in width, curved with concavity lateral; width at middle 0.16 of length; uniformly moderately pigmented, darker at base; shaft without spicules. Antennal hairs moderately pigmented except 1, 2-A; relative position, length, and degree of development as figured; all single; 1-A placed at 0.88 from base, length about 1.4 width of antenna.

Thorax: Long hairs and tubercles strongly pigmented; short hairs lightly pigmented; relative position, length, and degree of development as figured; apices of long hairs attenuated; long hairs with inconspicuous barbs or spicules; hair 5-P about 0.6 of head length. Prothorax: hair 0(3b), 1(1), 2(1), 3(2b), 4(3b), 5(1), 6(1), 7(2, 4b), 8(3, 4b), 9(1, 2b), 10–12(1), 14(1). Mesothorax: hair 1(3b), 2, 3(1), 4(3b), 5–7(1), 8(3b), 9–12(1), 13(3b), 14(4b). Metathorax: hair 1(2b), 2(3b), 3(2b), 4(1), 5(1), 6(1, 2f), 7(3, 5b), 8(3b), 9–12(1), 13(4, 5b).

Abdomen: Tubercles and long hairs very darkly pigmented, other hairs moderately to lightly pigmented; relative position, length, and degree of development as figured; long hairs with moderate barbs. No true stellate hairs. Hairs 6-I–V with basal tubercles. Segment I: hair 1(2b), 2(1), 3(3b), 4(2, 3b), 5(1), 6(2b), 7(1), 9(1), 10(2, 3b), 11(3, 4b), 12, 13(1). Segment II: hair 0(1), 1(3b), 2(1), 3(1, 2b), 4(1), 5(2b), 6(2b), 7(1), 8(1), 9(2b), 10(1), 11(2, 3f), 12(2b), 13(4b). Segment III: hair 0(1), 1(2, 3b), 2, 3(1), 4(1, 2b), 5(2b), 6(3b), 7(3b), 8(1), 9(3b), 10–12(1), 13(3b), 14(1). Segment IV: hair 0(1), 1(2, 3b), 2–4(1), 5(2b), 6(3b), 7(3, 4b), 8(1), 9(3b), 10–12(1), 13(3b), 14(1). Segment V: hair 0(1), 1(2b), 2(1), 3(2b), 4(1, 2b), 5(1, 2b), 6(3, 6b), 7(3b), 8(1), 9(2b), 10–12(1), 13(3b), 14(1). Segment VI: hair 0(1), 1(2b), 2(1), 3(2b), 4(1), 5(2b), 6(3b), 7(not seen), 8(1), 9(3b), 10(2b), 11, 12(1), 13(3b), 14(1). Segment VII: hair 0(1), 1(2b), 2(1), 3(3b), 4, 5(1), remaining hairs not visible. Segment VIII: comb plates united dorsally, strongly sclerotized, darkly pigmented, ornamented with strong imbrications from which minute spicules project; comb scales 6–6, sharply pointed, without lateral fringe but a few basal spicules as figured; hair 0(1), 1(2b), 2(1), 3(1, 2b), 4(2b), 5(2f, 4b), 14(1). Siphon: as figured; length slightly less than 2.0 median width; strongly pigmented, imbrications much heavier than on comb plate, spicules not distinct; pecten extending to 0.70, teeth 6–7, sharply pointed, heavily sclerotized and pigmented, without lateral fringe but with one or two short basal denticles; valves as figured, darker than siphon, all short; hair 1(2b), 2(1, well developed), 3–5 (only 2 setal rings visible), 6(1, well developed, longer than valve), 7(2b, minute), 8(2b, well developed, about 0.5 of valve), 9(1, slender, hook-like, inconspicuous), 10(1, minute), 11, 12(1, in a conspicuous alveolus), 13(1, simple hair, short). Segment X: saddle very short, lightly pigmented; median width about 2.0 of length; imbrications faint except caudally where two or three rows of short, darkly pigmented spicules arise from their apices but do not project from caudal margin of saddle; gills extremely long, sausage-shaped, 3.0 of saddle length; hair 1(2, 3b, minutely spiculate, about as long as saddle), 2 and 3 arise from large common tubercle, 2(1, about 3.9 of saddle length), 3(1, about 4.5 of saddle length), 4a(1, about 3.5 of saddle length), 4b(1, about 4.0 of saddle length), 4c(1, about 3.5 of saddle length), 4d(1, about 2.75 of saddle length), 4e(1, about 0.5 of saddle length).

Variation

Uranotaenia quadrimaculata adults vary a great deal in size and to a lesser extent in coloration. On Guadalcanal all individuals originating from taro show a conspicuous dark diagonal band running in line from the dark spot on *ppn* across the subspiracular area, upper middle part of *stp*, and lower middle part of mesopleuron just above the lower mesepimeral bristle. An indication of this dark integumentary band is present in specimens from other breeding places, but it is never conspicuous. I cannot find any structural characters to differentiate this ecological race either in the adults or in the immature stages.

The variation in the chaetotaxy of immature stages is shown in Tables 1 and 2. Although at first glance the variation does not seem to be great, actually it is much greater than in any species of mosquito I have studied, particularly in the larva. Not only the branching but also the degree of development of individual hairs varies a great deal. The position of smaller hairs is not as constant as it is in other species. There are cases of duplication of hairs in the larva. In the pupa there may be two extra pairs of hairs on the metanotum, probably representing larval hairs 3, 5-T; on the abdomen, hair 11 is frequently present on segments III–V, and there may be a duplication of hair 12 on these segments as well. One pupal specimen shows larval hair 9 retained on the left side of segment V. These anomalies have proved to be useful in establishing the homologies of the larval and pupal hairs. They may prove to be of value also when the potentialities of the mosquito chaetotaxy and its pattern as tools in genetics are realized.

The material from the other islands shows no variations that are not found on Guadalcanal, and there appear to be no characters on which geographical subspecies or races can be recognized within the Solomons.

Specimens examined: 288M; 310F; 96P; 866L. Individual rearings: 15 larval.

Taxonomic Discussion

Uranotaenia quadrimaculata is very closely related to *U. nigerrima* Taylor, 1914, from New Guinea. The two species are distinguished from all other *Uranotaenia* by the four dark integumentary spots, one each on the scutum in front of the wing root and the *ppn*. As pointed out by Edwards (1929: 314), *U. quadrimaculata* differs from *U. nigerrima* by the generally lighter thoracic integument, including the four dark spots, and the absence of a patch of broad white scales on the side of the scutum immediately above the anterior end of the *ppn*. Instead of the conspicuous broad white scales in this area as in *U. nigerrima*, in *U. quadrimaculata* there are a few elongate light-brown or cream-colored scales. The other characters mentioned by Edwards also hold but are difficult to determine because of considerable variation. Knight, Bohart, and Bohart (1944: 15) confused this distinction in their key by assigning to *U. quadrimaculata* the patch of broad, whitish scales which is characteristic of *U. nigerrima*. The remaining characters were properly assigned to the respective species. As a result of this confusion of characters Knight, Bohart, and Bohart (*loc. cit.*) referred specimens from the Solomons, New Britain, and New Guinea to both species. I have examined 23 adults of this group from several localities on New Guinea. They are all *U. nigerrima*. All the Solomons specimens are definitely *U. quadrimaculata*. The two species are allopatric, and there is no overlap whatever.

The larva of *U. quadrimaculata* is extremely close to *U. nigerrima*. The chief differences appear to be in the greater development in *U. quadrimaculata* of the following thoracic hairs: 4-P 3b(2–4) instead of 1, 2b; 7-P 2–4b instead of 1; 7-T 3, 2b(1–5) instead of 1, 2f. *U. nigerrima* has the comb scales with distinct basal spicules whereas these are never strongly developed in *U. quadrimaculata*. *U. nigerrima* also has more prominent basal spicules on the pecten teeth and strong apicolateral spicules on the anal saddle.

The pupa of *U. quadrimaculata* is very much like that of *U. nigerrima*. Penn (1949: 30) separated the two species on hair 10-II, simple in *U. quadrimaculata*, and 3, 4b in *U. nigerrima*. From a study of a series of *U. quadrimaculata*, this should be amended to 2b(1–3) for this species. Additional differences for *U. quadrimaculata* are as follows: 2-C 2b, 1(1–3) instead of 3b; 4-C single (1–2) instead of 2–3f; 5-C 2, 3b instead of 4b; apparently fewer branches on abdominal hairs 1 and 3.

Two other species from New Guinea are closely related to *U. quadrimaculata*. *U. papua* Brug, 1924, has a pupa with trumpets and paddles conforming to the type found in *U. quadrimaculata*. *U. diagonalis* Brug, 1934, has a larva with the typical features of the head, antenna, thorax, and abdomen found in *U. quadrimaculata*, including the dorsal connection of the comb plates. The figures of the male genitalia (Brug, 1934: 511) indicate the same type of mesosome. It is interesting to note that the characteristic dark diagonal integumentary pleural line of this species is strongly developed in specimens of *U. quadrimaculata* bred from taro.

Uranotaenia obscura Edwards, 1915, from Borneo and Singapore, has a very similar larva (Edwards and Given, 1928: 338–339) and undoubtedly belongs to the same group. *U. colocasiae* Edwards, 1928, from Fiji shows resemblance to this group in the larval stage also and may be related, but in the absence of specimens I cannot be positive. *U. painei* Edwards, 1935, from Fiji according to Edwards (1935: 128) is very much like *U. obscura*, *U. papua*, and *U. colocasiae* in the adult stage, but its larva is entirely different from all these and shows features of typical *Uranotaenia*.

The unornamented *Uranotaenia* of the Oriental region form a complex group of polyphyletic origin as shown by the different types of larvae. As several species are unknown in the immature stages and the available larval descriptions are not sufficiently detailed, and as it appears that superficially similar larvae are developed in similar habitats, it is impossible at the present to determine the relationship of the several species of this complex that are found in the Pacific area and to place *U. quadrimaculata* and related species in the natural order.

Biology

Uranotaenia quadrimaculata utilizes for breeding small water collections in living plants and dead plant material as well as various types of artificial containers. It is extremely common in leaf axils of taro (*Colocasia* sp. and *Alocasia* sp.) where it is preyed upon by *Tripteroides* (*Rachisoura*) *mathesoni* Belkin, 1950. It has also been found less commonly in tree holes in association with the usual tree hole breeders. The greatest number of individuals is produced from breeding in coconut shells, coconut spathes, and large leaves fallen on the ground. A few collections were made in fallen bamboo and in tree stumps. All sorts of artificial containers are also very favorable breeding grounds for this species. It has been recorded from tin cans, steel helmets, fire barrels, and cardboard containers. In all such situations it is preyed upon by *Tripteroides* (*Rachisoura*) *stonei* Belkin, 1950, which does not seem to be as effective a check as *T. mathesoni* in taro. I have two records of *U. quadrimaculata* apparently breeding in ground pools in a swampy jungle area and in road ruts. In both cases the larvae were collected following floods so it is very probable that they were washed out of their normal breeding places, such as coconuts or leaves.

U. quadrimaculata appears to prefer fairly fresh water in its breeding places. Only occasionally has it been found in thick, fermenting coconut water, such as is preferred by *Armigeres*. A moderate amount of organic matter is usually present in the majority of its breeding places, except in taro leaf axils.

The larvae of *U. quadrimaculata* bear no resemblance whatever to the typical *Uranotaenia* and most closely resemble species of *Armigeres* with which they are occasionally associated in coconuts. They behave like *Ar-*

migeres larvae also, spending most of the time at the bottom, coming to the surface only rarely, and moving with the same sinuous undulations of the body. They rest suspended down from the surface and not parallel to it as do ground-breeding *Uranotaenia*. The larvae are extremely large in comparison with the size of the adults. The extremely long sausage-shaped gills will separate them in the field from all forms found in similar habitats, except for *Armigeres*. Grossly they can be told from the latter by the much greater proportionate size of the head and the presence of long, lateral, abdominal hairs on the first four segments.

The pupae of *U. quadrimaculata* are also very different from those of other *Uranotaenia* as the trumpets are very short and relatively broad. The wide spacing of the trumpets will aid in recognizing them in the field from other species in similar habitats.

Adults are often seen in great numbers resting among coconuts on the ground and in their other breeding places. They have not been collected at lights.

Distribution

SOLOMON ISLANDS, *San Cristobal:* Malaupaina, Sept. 4, 1928 (R. W. Paine) [Paine and Edwards, 1929]. *Guadalcanal:* Rere, Aug. 19, 1928; Ilu, Aug. 26, 1928 (R. W. Paine) [Paine and Edwards, 1929]; generally distributed throughout the year on north-central and northwest coast (JNB *et al.*, J. G. Franclemont, K. L. Knight, A. B. Gurney, H. E. Milliron *et al.*, P. W. Oman, Lechner, Haage) [USNM, CU, JNB]. *Russell:* Banika, 1 adult, 2L, 2P, Mar. 20, 1943 (W. G. Downs) [USNM]. *New Georgia:* Segi Pt., 4 adults (B-3), 5L(B-33), 2L(B-77), 4 adults (B-130) (C. O. Berg); Munda Pt., 21 adults, 33L, 5P(F-69); 2M, 1F(F-18); 15M, 12F(F-19) (J. G. Franclemont) [USNM, CU, JNB]. *Treasury:* 11 adults (P-34) May–June, 1944 (J. H. Paullus) [USNM]. *Bougainville:* Empress Augusta Bay, 1L(W-4) Dec. 12, 1943; 16L(W-5) Nov. 17, 1943 (Weathersby and Koch); 9 adults, Jan. 28, 1944 (C. R. Bruck); 3 adults, 3L, 1P(G-230) Feb. 19, 1944; 6 adults (G-329) Apr. 16, 1944; 12 adults (G-341) Apr. 23, 1944; 1 adult (G-421) Jun. 27, 1944; 63 adults (G-433) (A. B. Gurney) [USNM].

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TABLE 1

LARVA. SETAL BRANCHING

Limits of variation in parentheses, preceded by most usual number(s) observed in ten specimens (20 hairs) in the order of frequency.

		atra	barnesi	civinskii	quadrimaculata	sexaueri	solomonis	wysockii
Head	0, 1, 3	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)
	4	2,3 (2-3)	1 (1)	3 (2-4)	1 (1)	2 (2-3)	3 (3-4)	4,3 (2-6)
	5	1 (1)	1 (1)	1 (1)	1 (1-2)	1 (1)	1 (1)	2 (2-3)
	6	1 (1)	1 (1)	1 (1)	1,2 (1-3)	1 (1)	1 (1)	1 (1)
	7	3 (2-3)	2 (1-3)	4,5 (4-6)	1 (1-2)	4 (3-5)	4 (3-5)	4 (3-5)
	8	2 (1-2)	2,3 (2-3)	3,2 (1-3)	1 (1-2)	3 (2-4)	1,2 (1-2)	2 (1-2)
	9	3 (2-3)	5,6 (4-7)	2,3 (2-3)	2,3 (2-4)	4 (2-5)	3 (2-4)	4 (4-3)
	10	1,2 (1-3)	3 (2-4)	1,2 (1-3)	1 (1)	2,1 (1-4)	1,2 (1-2)	2 (1-3)
	11	2,3 (1-3)	6,5 (4-8)	4,5 (3-6)	3,2 (2-4)	8,9 (8-10)	5 (4-7)	3 (2-4)
	12	2 (1-3)	3,2 (2-4)	2 (1-3)	1 (1)	3,2 (2-3)	2 (2-4)	2,3 (2-4)
	13	4 (3-6)	4,3 (2-6)	5,6 (4-7)	2,3 (1-3)	5,6 (4-7)	4 (3-6)	4,5 (3-7)
	14	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	13 (12-15)
	15	3 (2-3)	3 (3-5)	2,3 (2-3)	2,1 (1-3)	3,4 (3-5)	2 (1-3)	4,5 (3-6)
Antenna	1	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1-2)	3,2 (2-5)
	2-6	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)
Prothorax	0	8,9 (7-11)	8-10 (5-15)	12 (10-16)	3 (2-5)	15-18 (13-21)	9,8 (7-16)	5-7 (3-8)
	1	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)
	2	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)
	3	5,4 (3-5)	9,8 (7-10)	6-8 (5-10)	2 (1-2)	9,8 (7-10)	8,7 (6-10)	12-14 (10-19)
	4	2 (2)	2 (2)	3 (3)	3 (2-4)	2 (2)	2 (2)	2 (2)
	5	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)
	6	1 (1)	1 (1)	1 (1)	1 (1-2)	1 (1)	1 (1)	1 (1-2)
	7	1 (1)	1 (1)	2 (2)	4-2 (2-4)	2 (2-4)	2 (2-3)	2,3 (2-4)
	8	4 (3-5)	6,7 (5-9)	5 (4-7)	4,3 (3-6)	7,8 (7-9)	7 (5-10)	5 (4-7)
	9	1 (1)	4,5 (3-6)	2 (2-3)	1 (1-2)	4 (4-6)	2 (2-3)	2 (2-3)
	10	1 (1)	1 (1-3)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)
	11	3 (2-4)	3 (2-4)	3 (2-5)	1 (1-3)	3 (2-4)	2,3 (1-4)	2 (1-2)
	12	2 (1-3)	4,3 (1-4)	2 (1-3)	1 (1-2)	1,2 (1-3)	1 (1-2)	3,4 (2-5)
	14	1 (1)	1 (1)	6,5 (4-8)	1 (1-2)	14-16 (12-16)	1 (1)	1 (1-2)
Mesothorax	1	8 (6-9)	5,6 (4-7)	7,6 (5-9)	3,4 (1-5)	9-11 (8-12)	9,8 (6-9)	4,5 (4-5)
	2	1 (1)	1 (1-2)	1 (1)	1 (1)	1 (1-2)	1 (1-2)	2,3 (1-4)
	3	3,4 (1-4)	3 (2-6)	4,3 (3-5)	1 (1)	4,5 (3-6)	3,4 (2-4)	2-4 (1-4)
	4	4 (2-4)	4,5 (2-6)	5,4 (3-6)	3 (2-4)	4,5 (2-5)	3,2 (2-4)	4-5 (3-7)
	5	1 (1-2)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)
	6	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1-2)	1 (1)
	7	1 (1)	1 (1-2)	1 (1)	1 (1)	2 (2-3)	1 (1)	1 (1)

TABLE 1 (Continued) 2

		atra	barnesi	civinskii	quadrimaculata	sexaueri	solomonis	wysockii
	8	4,5 (4-5)	4 (4)	5,6 (5-6)	3,2 (2-5)	5 (4-6)	5 (5-6)	4 (4-5)
	9	4 (4-5)	5 (4-5)	5 (5-6)	1 (1)	5 (4-6)	5 (4-6)	5 (5)
	10	1 (1-2)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)
	11	1-3 (1-3)	1 (1-3)	1 (1-4)	1 (1)	3 (2-5)	1 (1-3)	1 (1-3)
	12	1 (1)	1 (1)	1 (1-3)	1 (1)	1 (1-4)	1 (1)	1 (1)
	13	15-20(8-21)	13-18(7-20)	20-25(16-30)	3,4 (3-5)	28-30(28-33)	30-35(26-36)	15-20(10-24)
	14	12-16(10-19)	16-19(11-21)	30-35(20-35)	5 (3-6)	28-32(18-32)	35-39(30-39)	15-20(10-23)
Metathorax	1	6 (5-7)	4 (4-5)	6 (4-7)	3 (2-4)	9,10 (7-11)	7,8 (5-11)	4,3 (3-5)
	2	2 (2-3)	1,2 (1-3)	3 (2-4)	3-1 (1-3)	2,1 (1-4)	2,3 (1-3)	2 (2-3)
	3	4,5 (4-6)	6,5 (4-6)	6 (5-7)	3,2 (2-3)	7,6 (4-9)	4-6 (4-8)	4,5 (2-5)
	4	3,2 (1-4)	2,3 (1-3)	5,4 (4-6)	1 (1-2)	4,3 (2-5)	3-5 (2-6)	3 (2-4)
	5	1 (1)	1 (1-2)	1 (1)	1 (1)	3,2 (1-3)	1,2 (1-2)	2 (1-3)
	6	2 (1-2)	3,2 (1-4)	2 (1-3)	1 (1-2)	3,2 (2-4)	2 (1-3)	2 (2-3)
	7	6-8 (6-9)	9,7 (6-9)	8 (7-11)	3,2 (1-5)	8 (7-8)	7,8 (7-8)	8 (6-10)
	8	10-12(6-12)	7 (5-9)	11-13(9-15)	3,4 (2-4)	13-11(8-15)	15-18(13-21)	10-14(8-19)
	9	4 (3-5)	5 (4-6)	5 (4-5)	1 (1)	5 (3-6)	5 (4-6)	5 (4-5)
	10	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)
	11	2 (1-4)	1 (1-2)	4,3 (2-5)	1 (1-2)	3 (3-5)	1 (1-2)	1 (1-3)
	12	2,3 (1-4)	2,1 (1-3)	2,3 (1-3)	1 (1-2)	3,2 (1-4)	2 (1-3)	1 (1-2)
	13	7 (6-8)	7 (6-7)	8 (7-9)	5,4 (4-5)	13-11(10-14)	9-11 (8-12)	5,6 (4-6)
Abd. I	1	5,6 (4-6)	4 (4-5)	6,7 (5-8)	2,1 (1-4)	8,7 (7-11)	8,7 (4-11)	4 (3-5)
	2	1 (1)	2 (1-3)	1 (1-2)	1 (1-3)	1 (1-2)	1 (1)	1 (1)
	3	1 (1)	1 (1-2)	1 (1-2)	2,3 (1-4)	1 (1)	1 (1)	1,2 (1-2)
	4	6,7 (4-8)	8,7 (7-11)	11-13(10-15)	3,2 (2-4)	13-11(9-17)	10,11(9-15)	8-10 (7-15)
	5	3 (3-4)	2,3 (2-4)	4 (3-5)	1 (1-2)	4,3 (2-5)	3,4 (2-5)	3,2 (2-4)
	6	2 (2)	3 (3)	2 (2)	2,1 (1-2)	2 (2)	3 (3)	2 (1-3)
	7	1 (1)	1 (1)	1 (1)	1 (1-2)	1 (1)	1 (1)	1 (1-2)
	8	2 (2-3)	2 (1-2)	2 (1-3)	absent	3,2 (1-5)	2 (1-2)	2,3 (2-3)
	9	4,5 (4-7)	3 (2-5)	9,8 (6-11)	1 (1-2)	5-7 (4-9)	8,7 (5-8)	6,5 (4-7)
	10	2,3 (2-3)	3 (1-4)	5 (3-6)	3,2 (2-5)	3,4 (2-5)	5 (1-4)	3,4 (1-4)
	11	absent	absent	absent	3 (2-4)	absent	absent	absent
	12	2,3 (1-3)	2,1 (1-3)	2 (1-3)	1 (1)	2,3 (1-3)	2,3 (2-3)	1,2 (1-2)
	13	2 (2)	3,2 (1-4)	2,3 (1-3)	1,2 (1-3)	3 (1-5)	1,2 (1-2)	2,3 (2-5)
Abd. II	0	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)
	1	5,6 (4-7)	4 (4-6)	6,5 (5-6)	2,3 (2-3)	9,8 (7-9)	6,7 (5-10)	4,3 (3-5)
	2	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)
	3	4,3 (3-6)	3 (2-5)	6,5 (4-6)	2 (1-3)	4,3 (1-5)	4,3 (3-6)	5,6 (1-8)
	4	5,4 (3-5)	6 (6-7)	6,5 (5-7)	1,2 (1-3)	7,8 (6-8)	6,7 (6-9)	3 (2-5)
	5	2,3 (1-3)	2,3 (2-4)	3,2 (2-4)	2 (1-2)	3 (3-4)	3,2 (1-4)	3 (2-5)
	6	2 (2)	3 (3)	2 (2)	2,1 (1-3)	2 (2)	3 (3)	2 (1-2)

TABLE 1 (Continued) 3

		atra		barnesi		civinskii		quadrimaculata		sexaueri		solomonis		wysockii	
	7	1	(1)	1	(1)	1	(1)	1	(1-2)	1	(1)	1	(1)	1	(1)
	8	2	(1-2)	2	(1-2)	1	(1-2)	1	(1)	2	(1-3)	2,1	(1-2)	1	(1-2)
	9	2	(2-3)	1	(1)	1	(1)	2	(1-3)	3,4	(3-5)	1	(1)	1	(1-2)
	10	2	(2-3)	2,3	(2-3)	2,3	(1-3)	1	(1-2)	3	(2-4)	2,3	(2-3)	2	(1-3)
	11	1,2	(1-2)	2,1	(1-3)	2,3	(1-3)	2,3	(1-3)	2	(1-4)	2	(1-3)	2,3	(2-4)
	12	1,2	(1-2)	2	(1-2)	2	(1-3)	2,3	((1-4)	2	(1-3)	1	(1)	2,3	(1-4)
	13	5	(4-5)	6,7	(5-7)	6,5	(4-7)	4,3	(3-5)	8,7	(7-12)	6,7	(5-7)	4	(3-5)
Abd. III	0	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)
	1	6,7	(6-8)	5	(5-6)	7	(5-8)	2	(2-3)	9,10	(7-11)	10-8	(6-14)	4	(3-5)
	2	1	(1)	1	(1)	1	(1)	1	(1-2)	1	(1)	1	(1)	1	(1)
	3	2	(1-2)	3	(2-3)	2	(2-3)	1	(1-2)	3,2	(2-4)	1,2	(1-3)	2,3	(1-3)
	4	2	(1-2)	3	(3)	2,3	(2-3)	1,2	(1-3)	2,3	(1-3)	1	(1-2)	2,3	(2-3)
	5	2	(1-3)	2,3	(2-3)	3	(2-4)	2	(1-3)	2	(2-3)	2,3	(1-3)	2	(2-4)
	6	6	(5-7)	7	(6-7)	6,7	(5-7)	2,3	(2-3)	8,7	(7-9)	7,8	(7-10)	4	(3-4)
	7	4,5	(4-5)	4	(3-4)	5,6	(3-6)	3	(2-3)	5,6	(2-7)	4,5	(4-7)	6	(6-9)
	8	1-3	(1-3)	2	(2)	2,3	(2-3)	1	(1)	3,2	(1-6)	2,1	(1-3)	2	(2-3)
	9	2,1	(1-2)	1	(1-2)	1	(1)	2,3	(2-3)	2	(1-3)	1,2	(1-2)	1	(1-2)
	10	2	(1-2)	3,2	(2-3)	2	(2-3)	1	(1)	2	(1-4)	2	(1-2)	2,3	(2-4)
	11	2,1	(1-3)	2,3	(2-3)	3	(1-4)	1	(1-2)	2,3	(1-5)	2,1	(1-3)	2,3	(2-4)
	12	2,1	(1-2)	1	(1-3)	3,2	(2-3)	1	(1)	2,1	(1-3)	2	(1-2)	2	(2-3)
	13	5	(4-6)	5,6	(5-6)	6,7	(5-7)	3,4	(2-5)	9-7	(7-12)	7,8	(6-10)	4	(3-5)
	14	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)
Abd. IV	0	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)
	1	6	(5-7)	5	(4-6)	7	(6-8)	2,3	(1-3)	10,11	(7-12)	8-10	(5-12)	4	(2-5)
	2	1	(1)	1	(1)	1	(1-2)	1	(1-2)	1	(1)	1	(1)	1	(1-2)
	3	1	(1-2)	2,1	(1-3)	2,1	(1-2)	1	(1)	1,2	(1-3)	1	(1-2)	1	(1-2)
	4	2	(2-3)	4	(3-5)	3	(3-4)	2,1	(1-3)	1-3	(1-4)	2	(2-3)	2	(2-4)
	5	2	(1-2)	2,3	(2-3)	3,4	(2-4)	2	(1-2)	2,3	(1-5)	2	(1-3)	2	(2-4)
	6	6,7	(6-7)	7	(6-9)	7,6	(6-9)	3,2	(2-3)	8,9	(7-11)	8-10	(7-11)	4,5	(4-6)
	7	4	(2-5)	2,1	(1-3)	5,4	(4-7)	3,2	(2-4)	5,4	(3-6)	5,4	(4-7)	5,6	(5-6)
	8	2,3	(1-3)	2	(1-2)	2	(2-3)	1	(1)	2,3	(2-3)	2	(1-3)	2	(2-4)
	9	1,2	(1-2)	1	(1)	1	(1-2)	2,3	(2-3)	1	(1-2)	1	(1-2)	1,2	(1-2)
	10	2	(1-2)	2	(2-4)	2	(2-3)	1	(1)	2	(1-4)	2	(1-2)	3	(2-4)
	11	1	(1-2)	1	(1)	1	(1-3)	1	(1)	1,2	(1-2)	1	(1-2)	1	(1-2)
	2	2,1	(1-2)	2,3	(1-3)	2	(1-3)	1	(1)	1,2	(1-3)	2	(2)	2,1	(1-3)
	13	5,4	(4-6)	5,6	(5-6)	6	(6-7)	3	(3-5)	8	(7-10)	7,6	(5-9)	4	(3-4)
	14	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)
Abd. V	0	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)
	1	6,5	(5-7)	5	(4-5)	7	(6-8)	2,3	(2-3)	10-9	(8-12)	10,11	(6-14)	4	(3-5)
	2	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1-2)

TABLE 1 (Continued)

		atra	barnesi	civinskii	quadrimaculata	sexaueri	solomonis	wysockii
	3	4,3 (3-4)	5 (4-6)	5,4 (3-6)	2,3 (2-3)	4,5 (3-6)	3,2 (2-5)	4,3 (3-5)
	4	2 (1-2)	2,3 (2-4)	3,2 (2-3)	2,1 (1-2)	2,3 (1-4)	2 (1-2)	3,2 (2-4)
	5	2 (2)	2 (1-3)	4-2 (2-4)	2 (1-2)	3,2 (1-4)	2 (1-3)	2,3 (2-4)
	6	6 (6-7)	7 (6-8)	7,6 (6-9)	3,2 (2-6)	9 (7-10)	9,10 (8-11)	4,5 (4-5)
	7	4,5 (4-6)	3-5 (2-5)	5 (4-6)	3 (2-4)	4,3 (3-8)	5,6 (3-8)	6 (4-6)
	8	2,3 (2-3)	2,1 (1-2)	3,2 (2-4)	1 (1)	2,3 (1-3)	2 (1-3)	2,3 (2-3)
	9	2,1 (1-2)	1 (1)	1 (1)	2 (2-3)	1 (1-2)	1,2 (1-2)	2,1 (1-2)
	10	2,1 (1-2)	2,3 (2-3)	2,3 (2-3)	1 (1)	2 (1-3)	2,1 (1-2)	2,3 (1-3)
	11	1 (1-2)	1 (1)	1 (1)	1 (1)	1,2 (1-2)	1 (1-2)	1 (1)
	12	2 (1-2)	2 (1-3)	3 (1-3)	1 (1-2)	1,2 (1-3)	2 (1-2)	2,1 (1,2)
	13	6,5 (4-7)	5-7 (5-7)	6,7 (5-8)	3 (3-5)	8,7 (7-9)	8,7 (6-9)	4 (4-5)
	14	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)
Abd. VI	0	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)
	1	6 (5-7)	4 (3-5)	8,7 (5-9)	2,3 (2-3)	9-11 (8-12)	7-9 (6-14)	3,4 (2-4)
	2	1 (1)	1 (1)	1 (1)	1 (1-3)	1 (1)	1 (1)	1 (1-2)
	3	2,3 (2-3)	4 (4-6)	3 (2-4)	1,2 (1-2)	2 (2-4)	2,3 (1-3)	3,2 (2-4)
	4	2,3 (2-3)	3 (3-4)	3 (2-5)	2,1 (1-2)	4,3 (3-4)	2 (1-3)	3 (2-4)
	5	2 (1-3)	2,3 (2-3)	3 (2-4)	2 (1-2)	2,3 (1-4)	2 (2-3)	3,4 (2-4)
	6	7 (5-8)	7,6 (6-7)	9-7 (5-12)	3,2 (1-3)	9-7 (6-12)	11,10(8-14)	5 (4-7)
	7	3,4 (2-5)	3 (2-4)	3-5 (3-5)	3,2 (2-3)	3 (3-5)	3,2 (2-4)	5,4 (4-6)
	8	3,2 (2-3)	1,2 (1-2)	3,2 (2-4)	1 (1-2)	2,3 (1-3)	2 (1-3)	3,2 (2-3)
	9	2 (1-2)	1 (1)	1 (1)	2,3 (2-3)	2,1 (1-3)	1 (1-4)	2 (1-2)
	10	2 (1-3)	2 (1-3)	2,1 (1-3)	1 (1)	2 (1-3)	2 (1-3)	2,1 (1-3)
	11	2 (1-2)	3 (2-3)	2 (2-3)	1 (1)	3 (2-3)	2,1 (1-3)	2,3 (1-4)
	12	2 (1-3)	2,1 (1-3)	2 (2-3)	1 (1)	3 (2-4)	1,2 (1-4)	2 (2-3)
	13	15-17(8-18)	15-19(12-21)	25-30(20-33)	2 (1-4)	25-30(19-32)	22-25(20-31)	15-19(10-20)
	14	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1-2)	1 (1)
Abd. VII	0	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)
	1	5,6 (4-7)	4 (4)	6-8 (5-9)	2,3 (2-3)	8,9 (6-10)	7-9 (5-10)	4 (2-4)
	2	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1-2)
	3	8,7 (6-9)	6 (5-7)	8-10 (8-10)	3,2 (2-3)	12,13(11-15)	11 (7-15)	4 (3-5)
	4	2 (1-3)	1,2 (1-4)	2,3 (1-3)	1 (1)	2 (1-4)	1,2 (1-3)	2,1 (1-4)
	5	2,3 (2-4)	2 (2-3)	3-5 (2-5)	2 (2)	3 (2-5)	3,2 (1-4)	2,1 (1-4)
	6	4,5 (3-6)	4,5 (2-6)	6,7 (5-10)	3,2 (2-4)	7,6 (5-8)	6,7 (5-9)	5,6 (4-7)
	7	2,3 (1-4)	2,3 (1-3)	4 (2-5)	2,3 (2-3)	3,2 (1-4)	4 (3-6)	2 (2-3)
	8	5,5 (4-6)	1,2 (1-2)	8-10 (6-11)	2 (2-4)	6-8 (6-9)	7,8 (6-9)	4 (3-6)
	9	1,2 (1-3)	1,2 (1-2)	2 (2-3)	2,3 (2-3)	2 (2-4)	3,2 (2-4)	2 (2-4)
	10	2 (1-2)	2 (2)	2 (2-3)	1 (1)	2 (2-3)	2,1 (1-3)	2 (1-3)
	11	2 (1-3)	3 (2-4)	3 (2-3)	1,2 (1-2)	4,5 (3-6)	3 (2-4)	2 (2-3)
	12	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)

TABLE 1 (Continued)

		atra	barnesi	civinskii	quadrimaculata	sexaueri	solomonis	wysockii
	13	5 (4-6)	4,5 (4-6)	5,6 (5-6)	3 (2-5)	8,9 (6-10)	7 (6-8)	5,4 (4-6)
	14	1 (1)	1 (1)	1 (1)	1 (1)	1 (1-2)	1 (1-2)	1 (1)
Abd. VIII	0	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)
	1	4 (3-5)	3-5 (3-5)	4,5 (3-6)	2 (1-3)	5,6 (4-7)	5 (4-7)	2 (2-3)
	2	3 (1-3)	2,3 (1-4)	3 (1-4)	1 (1-2)	2,3 (1-5)	1,2 (1-3)	2 (1-3)
	3	5,4 (4-5)	5 (4-5)	6,5 (4-6)	1 (1-2)	7 (7-9)	6,7 (5-8)	5,6 (2-8)
	4	2 (1-2)	2 (1-3)	3,2 (1-6)	1,2 (1-3)	2,1 (1-5)	1,2 (1-2)	2 (1-3)
	5	7,8 (5-9)	8,7 (6-8)	8,9 (5-10)	3,2 (2-4)	10,11(6-12)	10-8 (7-12)	4 (3-5)
	14	1 (1)	1 (1)	1 (1)	1 (1)	1 (1-2)	1 (1)	1 (1-2)
	Comb	7,8 (5-8)	10,9 (8-11)	8,9 (6-9)	5,6 (3-7)	6-8 (6-8)	8,7 (7-10)	8,7 (6-9)
Siphon	1	9-11 (7-11)	11,10(10-13)	10,9 (8-13)	2 (2-3)	8,7 (6-9)	10,11(9-13)	4 (3-5)
	2	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)
	3-6	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)
	7	1 (1)	1 (1)	1 (1)	2 (1-2)	1 (1)	1 (1)	1 (1)
	8	1 (1)	1 (1)	1 (1)	2 (2)	1 (1)	1 (1)	1 (1)
	9-13	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)
	Pecten	13,12(10-15)	12,13(11-14)	16,15(13-18)	7,6 (5-8)	14,12(12-16)	11 (11-13)	19-21(13-25)
Abd. X	1	7-9 (6-10)	5 (3-6)	5,4 (4-7)	2,1 (1-3)	6,5 (5-6)	5 (5-7)	2 (2)
	2	2 (2)	4,5 (4-5)	3 (3)	1 (1-2)	3 (2-4)	3 (3)	3 (3-5)
	3	2 (2)	2 (2)	2 (2)	1 (1-2)	2 (2)	2 (2)	2 (2-3)
	4a	2 (2)	2 (2)	3 (3)	1 (1)	3 (3)	3 (3)	2 (2)
	4b	2 (2-3)	2 (2)	2 (2)	1 (1)	2 (2)	2 (2)	1 (1-2)
	4c	1 (1)	1 (1)	1 (1)	1 (1)	1 (1-2)	1 (1)	1 (1)
	4d	1 (1)	1 (1)	1 (1-2)	1 (1)	1 (1)	1 (1)	1 (1)
	4e	1 (1)	1 (1)	1 (1)	1 (1-2)	1 (1)	1 (1-2)	1 (1)

TABLE 2.

PUPA. SETAL BRANCHING

Limits of variation in parentheses, preceded by most usual number(s) observed in ten specimens (20 hairs) in the order of frequency.

* secondarily branched at apex.

		atra	barnesi	civinskii	quadrimaculata	sexaueri	solomonis	wysockii
Cephalothorax	1	7 (5-9)	10,9 (8-13)	5 (5-7)	1 (1-2)	6 (4-8)	5 (4-7)	4,3 (3-4)
	2	6,5 (5-7)	7,8 (7-10)	5 (5-7)	2,1 (1-3)	6,5 (5-7)	5 (3-5)	4,5 (3-7)
	3	7,6 (5-10)	7,8 (7-10)	6,5 (5-7)	1,2 (1-3)	7-5 (5-7)	5 (3-6)	5,6 (4-7)
	4	9 (8-10)	14-12(9-16)	6,5 (4-8)	1 (1-2)	7,6 (6-8)	7,8 (5-8)	4,3 (3-5)
	5	11 (5-11)	12-14(10-17)	7,6 (6-10)	2,3 (2-3)	8,9 (5-9)	6,7 (5-9)	4,3 (3-5)
	6	1 (1)	1 (1)	1 (1-2)	1 (1)	1 (1)	1 (1)	1 (1)
	7	5 (4-6)	6,7 (4-7)	4,5 (3-6)	2 (1-3)	6,5 (3-7)	4 (3-6)	2 (1-3)
	8	6,7 (5-7)	5,4 (4-6)	6,7 (5-11)	4,3 (3-5)	8,9 (7-10)	7,6 (6-8)	7-9 (6-10)
	9	9,8 (7-10)	9-11 (6-11)	6,5 (4-8)	1 (1)	6,7 (5-8)	4,5 (3-6)	4 (2-5)
	10	7-5 (4-8)	5,6 (3-6)	4 (3-6)	2 (1-2)	5 (4-7)	4,3 (2-4)	2 (1-4)
	11	4,3 (3-5)	5,4 (4-7)	2,3 (2-4)	1 (1)	4 (3-5)	5,4 (4-6)	4,3 (3-6)
	12	7,8 (6-9)	10,9 (6-11)	5,6 (4-7)	1 (1)	5,4 (3-6)	3,4 (3-5)	3,2 (2-4)
Abd. I	1	14-16(12-17)	16-19(16-25)	18-20(14-22)	11-13(9-17)	15-20(14-25)	20-29(19-30)	18-22(15-24)
	2	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1-2)
	3	3,4 (3-4)	4 (4-5)	3 (2-3)	1 (1)	5-3 (3-6)	4-6 (4-7)	4,3 (3-4)
	4	6-8 (6-8)	7,8 (4-9)	6,5 (5-7)	2,3 (1-3)	6-4 (3-8)	6 (5-8)	4 (1-5)
	5	2,1 (1-5)	4 (1-6)	3,4 (1-7)	1 (1)	4 (1-7)	3-5 (3-7)	3,2 (1-4)
	6	4,3 (3-6)	7,6 (5-9)	3 (2-4)	1 (1)	3 (3-4)	2 (2-3)	1 (1-2)
	7	2 (1-3)	1,2 (1-2)	2,3 (2-3)	1 (1)	2 (1-2)	2 (2-4)	1 (1-4)
	10	4 (3-5)	3,4 (3-5)	3-5 (2-5)	2 (2)	5,4 (3-5)	3,4 (2-5)	3,2 (1-3)
Abd. II	0	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)
	1	9-7 (6-10)	10-12(8-13)	4,5* (3-8)	1,2 (1-5)	6,7 (5-8)	10,11(8-13)	4,5 (3-8)
	2	3,4 (2-5)	5,4 (3-5)	3,2 (2-4)	1 (1-2)	4,5 (2-6)	5-7 (5-9)	2,3 (1-4)
	3	7,6 (5-8)	10-14(10-14)	4,5 (3-5)	1 (1)	4,5 (4-5)	5,6 (4-7)	2,3 (2-3)
	4	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1-2)	1 (1)
	5	3,4 (3-4)	3,4 (3-5)	4,3 (3-6)	2,3 (1-4)	3,4 (1-5)	5-3 (3-7)	2,3 (2-4)
	6	3 (2-3)	5,6 (4-6)	2 (2-3)	1 (1-2)	2 (1-3)	2 (2)	1 (1)
	7	1 (1)	1 (1)	1 (1)	1 (1)	1,2 (1-2)	1 (1)	1 (1)
	8	absent	absent	absent	1 (1)	absent	absent	absent
	10	5,4 (3-5)	4,3 (2-5)	2,3 (2-7)	2 (1-3)	3,4 (1-4)	4,3 (2-5)	3,2 (2-3)
	12	absent	absent	absent	0,1 (0-2)	absent	0 (0-2)	absent
Abd. III	0	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)
	1	8,9 (7-10)	12-10(8-14)	6,7 (5-8)	1,2 (1-2)	6,7 (6-9)	7,8 (6-10)	3 (2-5)
	2	1 (1)	1 (1)	1 (1-2)	1 (1)	1 (1)	1 (1)	1 (1)
	3	7 (6-10)	12-14(7-19)	6,5 (5-7)	1 (1)	6 (4-7)	8,7 (7-11)	3 (2-4)
	4	3 (3-4)	4,3 (2-6)	3 (2-4)	1 (1)	4 (3-6)	6,5 (3-8)	3,4 (3-5)

TABLE 2 (Continued)

		atra		barnesi		civinskii		quadrimaculata		sexaueri		solomonis		wysockii	
	5	3,4	(3-5)	3	(2-4)	3	(2-5)	2	(1-2)	3	(2-4)	3,2	(2-4)	3,2	(2-4)
	6	4	(3-5)	6	(5-7)	4	(4-5)	1	(1-2)	3	(2-3)	3,2	(2-4)	1	(1-2)
	7	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)
	8	2,3	(1-3)	2,3	(2-5)	2,3	(1-3)	1	(1)	2	(1-3)	2	(2-4)	2	(1-4)
	10	4-2	(1-4)	2	(1-5)	3,4	(3-6)	2	(2-3)	2,3	(2-5)	3	(2-4)	2-4	(1-4)
	12	3	(2,3)	3	(3-4)	3	(2-4)	1,2	(1-3)	3	(1-3)	2	(1-3)	2	(1-4)
	13	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)
	14	1	(1)	1	(1)	1	(1)	1	(0-1)	1	(1)	1	(1)	1	(1)
Abd. IV	0	1	(1)	1	(1)	1	(1-2)	1	(1)	1	(1)	1	(1)	1	(1)
	1	7-5	(4-8)	10-12	(6-12)	5,6	(4-7)	2	(1-2)	6	(5-9)	6,7	(5-9)	3,4	(3-4)
	2	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)
	3	5,6	(4-6)	7,6	(4-8)	6,5	(4-6)	2	(2-4)	6,5	(4-7)	6,7	(4-8)	4,5	(3-6)
	4	1	(1)	3,4	(2-5)	5	(4-8)	1	(1)	6	(5-7)	6-8	(5-9)	3	(3)
	5	3	(1-4)	3,4	(1-5)	2,3	(2-4)	2	(1-2)	3,2	(1-3)	3,2	(2-3)	2,3	(2-3)
	6	4	(3-5)	7	(4-8)	4	(3-4)	1	(1-2)	3	(2-4)	2,3	(2-4)	1	(1)
	7	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)
	8	3,2	(2-6)	2-4	(2-4)	4	(2-5)	2	(1-3)	3,4	(1-4)	4,5	(3-5)	2-4	(1-4)
	10	2,3	(1-3)	2	(2-4)	2,3	(1-4)	2	(1-2)	2	(1-3)	3	(2-4)	3	(2-4)
	12	3	(2-3)	3	(2-4)	2-4	(2-4)	1	(1-2)	2,3	(1-3)	2	(2-3)	2	(1-3)
	13	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)
	14	1	(1)	1	(1)	1	(1)	1	(0-1)	1	(1)	1	(1)	1	(1)
Abd. V	0	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)
	1	5,6	(4-7)	7	(5-9)	4,5	(4-6)	2	(1-3)	5,6	(4-6)	5	(4-6)	3,4	(2-4)
	2	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)
	3	3,4	(3-4)	3,4	(3-4)	3,4	(2-4)	2	(2)	4,3	(2-5)	3	(2-4)	3,4	(2-4)
	4	1	(1)	3	(2-4)	3	(2-5)	1	(1)	6	(5-7)	5,6	(4-7)	3	(3-4)
	5	4,5	(3-5)	5,6	(3-6)	4	(3-6)	2	(1-3)	4,5	(3-6)	5,6	(4-7)	4,3	(2-4)
	6	4	(3-5)	6,7	(3-9)	3,4	(3-4)	1	(1-2)	3	(2-4)	3,2	(2-4)	1	(1-2)
	7	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)
	8	2-4	(1-4)	2,3	(2-3)	4	(3-5)	2,1	(1-2)	2,3	(1-3)	4	(2-5)	3	(2-4)
	10	4	(2-5)	4,5	(3-5)	4,5	(3-7)	2	(2-3)	4	(2-5)	4,5	(3-6)	3,2	(1-4)
	12	3,2	(2-4)	2,3	(2-3)	2	(1-3)	1	(1-2)	3,2	(1-4)	2	(1-3)	2	(2-5)
	13	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)
	14	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)
Abd. VI	0	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)
	1	5	(4-7)	5,6	(4-7)	4,5	(3-6)	2	(1-3)	5,4	(4-6)	5,4	(3-6)	4,3	(3-5)
	2	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)
	3	3	(2-4)	4,3	(2-5)	3	(1-4)	2	(2-3)	4,3	(1-4)	3,2	(1-3)	3,4	(2-4)
	4	2	(1-2)	4	(3-5)	3	(2-4)	1	(1)	5,4	(3-6)	5,4	(4-6)	3	(3)
	5	4,5	(4-5)	5,6	(3-6)	4,3	(2-4)	2	(1-2)	4,5	(3-6)	3	(3-4)	4-2	(2-5)

TABLE 2 (Continued)

		atra		barnesi		civinskii		quadrimaculata		sexaueri		solomonis		wysockii	
	6	4	(3-5)	5-7	(4-7)	3,4	(3-4)	1	(1)	3	(3-5)	3,2	(2-4)	2	(2-3)
	7	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)
	8	2,3	(2-4)	3,2	(1-4)	3,2	(1-4)	2	(1-3)	2,3	(1-3)	4-2	(2-5)	2,3	(1-4)
	10	3	(2-3)	3	(1-4)	2	(1-3)	2	(1-2)	2	(1-3)	3,2	(1-4)	2	(1-3)
	12	2	(1-3)	2	(2-3)	2	(1-2)	2,1	(1-2)	2,3	(2-3)	2	(1-3)	2	(1-3)
	13	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1-2)	1	(1)
	14	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)
Abd. VII	0	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)
	1	5,4	(3-6)	6,5	(5-7)	3,4	(3-5)	2,1	(1-3)	4	(3-5)	4,5	(3-6)	3,4	(3-5)
	2	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)
	3	4,5	(3-6)	5,6	(4-7)	5,4	(3-5)	2	(2)	5,4	(4-6)	6,5	(3-6)	7,6	(5-8)
	4	2	(2)	5,4	(4-6)	3	(2-5)	1	(1)	5,4	(4-5)	5,4	(3-6)	3	(3-4)
	5	4	(3-4)	4-6	(2-6)	3,2	(1-4)	1,2	(1-2)	4	(2-5)	3	(2-3)	2,3	(2-5)
	6	4	(2-4)	5	(3-6)	3,4	(2-4)	1	(1)	3	(2-4)	3,4	(3-4)	3,4	(3-6)
	7	1	(1-2)	1	(1-2)	1-3	(1-3)	1	(1)	3	(1-3)	2,3	(2-3)	2,3	(1-4)
	8	4,3	(2-5)	3-5	(2-5)	4,3	(2-5)	3,2	(2-3)	3,4	(2-5)	4,3	(2-5)	3,4	(1-6)
	10	3,2	(2-3)	3	(2-4)	2	(1-3)	2	(1-3)	2	(2)	2,3	(2-3)	2	(1-3)
	12	2,3	(2-3)	3	(2-3)	2,3	(1-3)	1	(1-2)	3,2	(2-3)	3	(1-3)	3,2	(2-4)
	13	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1-2)	1	(1)
	14	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)
Abd. VIII	0	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)
	4	5,4	(4-5)	5,6	(4-8)	3	(1-5)	1	(1)	3,4	(1-4)	3	(2-4)	3	(2-4)
	7	4	(3-5)	4	(3-6)	3	(2-5)	1	(1-2)	3,2	(2-5)	3	(2-5)	7-9	(5-16)
	14	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1-2)
Abd. IX	1	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)	1	(1)
Paddle	1	1	(1)	1	(1)	1	(1)	1	(1-2)	1	(1)	1	(1)	absent	
	2	absent		absent		absent		1	(1-2)	absent		absent		absent	